October

RADIO AND HOBBIES IN AUSTRALIA

VOL. 1, No. 7

In this issue

A "WIRELESS WEEKLY" PUBLICATION

A New Triumph of Radio Engineering

Radio has made gigantic strides in recent years. Newest development is the sensational 1.4 volt economy valve that has made possible an entirely new type of set for country listeners. Operating entirely from Eveready dry batteries, using no more current than an ordinary electric torch, and eliminating the need for an accumulator, it offers listeners greater economy and convenience than ever before.

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With the Editors

THE FUTURE

Since the September issue of "RADIO AND HOBBIES" went to press, th Empire has become involved in war. We, in common with millions of others, hope against hope that such an event would not come about. Now that the die has be cast, it is our plain duty to adapt ourselves to the change in circumstances, ar review our policy accordingly.

You will agree that, for the present at least, the duty of all loyal Australia who cannot be of immediate assistance to the nation in a practical manner, is to c whatever they can to preserve the normal avenues of business. Nothing at all ca be gained by paralysing our industrial and social lives in a mistaken idea that w are thus consolidating our position. You have all become familiar with the sloga "Business as Usual," which has been suggested to us by the Prime Minister in h messages to the nation. We can best help to maintain stability and confidence Australia by doing everything possible to live up to it.

And so, with "RADIO AND HOBBIES," our slogan will be in the future ju this—"Business as Usual." You will see by this issue that, if anything, our paper more comprehensive and more interesting than ever. The same number of page the same distribution of interests, the same advertising support, are here. It is ou earnest determination that things shall remain so, and with your willing assistanc and the assistance of all who help to make our paper what it is, we at least have n doubt they will.

More than this—we feel we can justly claim, at this stage in our existence, tha we have won for ourselves a place which cannot easily be abandoned. Life must g on, and we must improve our knowledge, seek our entertainment, and our instructio just as we have always done. We cannot help our country in its great task b sitting in a corner brooding over possibilities which may never happen. The pleasur and the profit which you have gained from our magazine are just as important to a of us as ever they were. We feel that in working to give them to you we are doin our part, in our own special manner, in preserving the normal life of the community.

More than this—we are fortunate in that the various subjects covered in "RADIO AND HOBBIES" are nearly all such as to help every reader to understand bette the problems of the day, particularly in Radio and in Aviation. These two, more than any others, will affect communication between ourselves and between nations. A better knowledge of what is happening in connection with them can only help us to approach our problems with a more informed mental attitude.

To the younger readers we say that there is no better hobby they can pursue than one which will be of a practical value to them, and which will better enable them to understand what is going on in the world about them.

The sum total of all these various matters, will have its ultimate bearing on the morale of our people. If we can do anything at all to maintain or improve this morale, then our work has been well and truly worth while.

Thus we shall pursue our activities with, if possible, even greater determination and energy, enlarging the scope of our paper if required, to increase its effectiveness. If you continue to support us with anything like the enthusiasm you have shown in the past, we shall not fail.

OUR ADVERTISERS

May we say here that our advertisers have indeed set an example in their refusal to be rushed into any unjustified semblance of panic or depression in the last few weeks. We would like to express our thanks to them, for their assurances of co-operation and good-will. We, in our turn, would like to point out that their future is largely bound up with yours and ours. When you are setting out to make up some of the designs appearing in our pages, or any others for that matter, remember their appearance in the paper means they have taken steps to inform themselves of your special requirements.

Thus, no matter what shall eventuate, "RADIO AND HOBBIES" has no intention of allowing difficulties to affect its policy. Difficulties never were an excuse for failure. On the contrary, in overcoming them we find our strength.

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A. G. HULL.

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JOHN MOYLE.

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FEATURE STORY

RADIO BROADCASTING IN THE FUTURE

Mr. David Sarnoff.

☆

Public hearing before the Federal Communications Commission in Washington, D.C., in connection with an investigation and study of the practices of radio broadcasters in U.S.A., commenced in November, 1938. The first witness to appear was David Sarnoff, president of R.C.A. and chairman of the N.B.C. The section of his testimony given here is of exceptional interest, for it represents the views of a man who is regarded as one of radio's leading executives. It was given on May 17, 1939.

☆

Question: Mr. Sarnoff, you mentioned some prospective developments. Is it your opinion that in the immediate future there are any developments which will materially change the present network structure?

Answer: My opinion is that there are developments ahead which are bound to affect the whole radio structure. How immediate those effects will be is a matter of speculation, because I think they depend on three elements. They depend: I should say first and foremost, on the work of the laboratory, what the engineers and the scientists who are at work in these new fields can perfect and develop; they depend also on the financial and economic situation, the ability of these organisations that are carrying on these scientific developments to finance them in new fields, and they depend also upon the attitude, if I may respectfully submit, of this Commission and the Government, generally—as to what the attitudes of our Government and our regulating bodies are going to be toward these new developments. And I say that, not with any criticism, because I have no fault to find with the attitude of this Commission towards the development of radio, but I am speaking of the future, and, of course, I do not know what their attitude in the future may be.

Those three elements together, scientific development, financial capacity, and Governmental encouragement, will determine the rate at which these effects will take place.

Now, to be more specific as to the kind of developments I have in mind.

You will, perhaps, permit me to say that I have been in this art and industry since I was knee-high to a grasshopper. I started in 1906, and for 33 years I have watched and participated in the development of this art. I have seen technical revolutions take place in this art almost with five-year regularity. Beginning with the early days, there was the spark system of telegraphy, ship-to-shore, and that spark system gave way to continuous waves generated by tubes. Then, you had the tube system of communication. That was a revolution, changing the apparatus that was then in use, and the methods, and the space occupied in the ether by undamped waves as against damped oscillations, and so on. Then came the development of the wireless telephone, about the war time, which was another revolution, in that, the human voice as well as the code signals could be transmitted through space. And, then came the development of trans-oceanic communication which, for the time being at least, subordinated in importance, all the other methods of radio communication, and that represented another technical revolution. The waves were generated by alternators and long waves of the order of 12,000 to 20,000 meters were employed. Then, just about the time these trans-oceanic facilities were established, at great expense, in one case at Port Jefferson, Long Island, we built a station with seventy-two 400-foot towers and 10 square miles of land with eighteen 200-kilowatt alternators at a cost of about 10,000,000 dollars and by the time the final paint was on the buildings, it was obsolete because short waves came into existence. Where once they were regarded as ineffective methods of trans-oceanic communication, they became the most effective method.

IN THE EARLY DAYS

I can remember, as a wireless operator, in the days of Marconi, in 1908 and '09, I was a wireless operator at a little station called Seagate in Coney Island and at another one, Siasconset on Nantucket Island, and we then had two methods of signalling, one was short-wave called Tune "A" and the other was long-wave called Tune "B." Tune "A" used waves of 100 metres and below, and Tune "B," 350 metres and above. This was ship communication. Everybody had assumed, then, that the Tune "A" waves could communicate at a range of about 50 miles and no longer,

AS VISUALIZED BY DAVID SARNOFF

because short waves could not travel very far. If you wanted to cover distance, you had to use Tune "B." Well, out of this Tune "A"-Tune "B" business arose these 12,000 to 20,000 metre waves on the theory that the longer the wave, the better chance you had to negotiate the longer distance. We now find that if you want to cover a very long distance, you want to use a very short wave; so that it is easier to-day to communicate from New York to Australia with a wave length of around 14 metres than it would be with a wave length of 14,000 metres. In fact, you could not do it at all with the latter. And these big alternators, big towers, and big buildings have gone their way; they have been interred, but somebody had to pay the price of that development.

RADIO BROADCASTING

Now, we come to broadcasting. At the present time, the waves give to broadcasting a limited capacity. The average person thinks of a broadcasting station as one that can reach the entire nation. I have had ever so many people ask me, in referring to this latest development of television, for example, when we say that the station has a range of about 50 miles: "Well, what good is a 50-mile range? You have got to have the range of a station that is able to reach from New York to California." Now, their mental impression is that the present sound broadcasting station reaches California, and, of course, we here all know that it does no such thing. The average range of a broadcasting station to-day, its useful range, is really not much greater than that of an average television station, 50 to 100 miles. It is when you are inter-connected with another station that you give it that additional range. And so, within this limitation of the band, I think that broadcasting, as we know it to-day, has reached about the limit of its technical capacity. I do not mean that there will not be refinements and improvements, but I think that the art in its present space has reached, more or less, saturation; and yet I believe that radio, the radio art itself, is a long, long way from saturation; in fact, that it is still in its infancy. Waves that were once thought useless are daily becoming more and more valuable.

PROBLEMS OF TECHNOLOGY

The problems faced by this Commission, the problems faced by the Government, and the problems faced by the industry, after all is said and done, can be summarised in one word: "Technology" or "science."

If we could have all the wave lengths that you and I want, a great many of these problems which we must now properly discuss and deal with would disappear. There might be other problems, but they would not be primarily of a technical nature. In other words, if it were as easy for an American citizen to establish a broadcasting station, or if he were as free to establish a broadcasting station as he is free to establish a newspaper or a magazine, assuming that he has the wherewithal, then this whole body of regulation and this character of question would take on a different aspect.

Therefore, the problem is, and the solution must be, to expand the usefulness of radio, to find new means of communication, to make 2 or 100 or 1000 blades of grass grow where only one grows to-day.

HUNDREDFOLD MORE CHANNELS

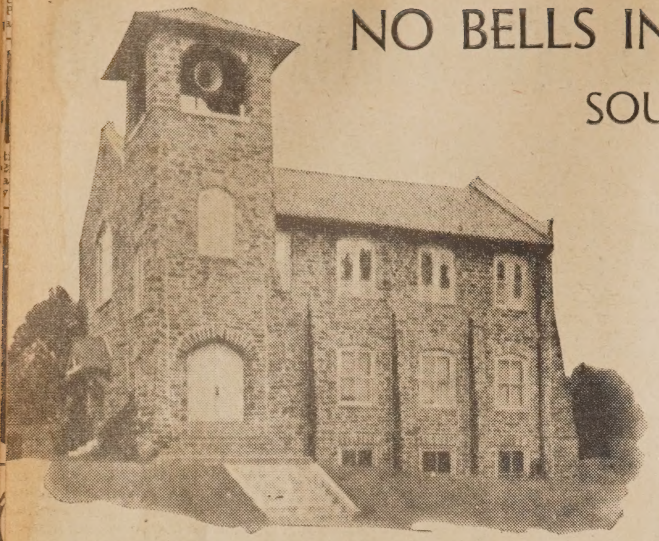
Based on my experience in the past, based on my observations of what is going on in the art, and my contacts with our scientists and engineers, I have no hesitation in saying to you that in my opinion the number of channels for radio communication which it is possible to develop into useful channels are many, many times the number that now exist. In fact, they may be a hundred-fold or a thousand-fold as great. We now speak not in terms of long waves or short waves, we refer to ultra-short waves, to centimetre waves,

(Continued on Next Page)

FEATURE STORY

NO BELLS IN THIS BELFRY!

SOUND EQUIPMENT INSTEAD



Elsewhere in this issue will be found an article dealing with the use of "electric chimes" for use in a church tower, in place of the conventional bells. Here is a picture of a church in U.S.A. which has been converted to electric chimes. The loud-speaker horns can be seen in the tower itself.

SARNOFF AND RADIO

(Continued from Previous Page)

o millimetre waves, and we talk of modulating these waves hrough frequency modulation, through amplitude modulaion, through phase modulation, or a combination of these nethods.

Commissioner Brown: Are you speaking of broadcasting r radio services as a whole?

The Witness: I am speaking of all phases of radio, ncluding broadcasting, Mr. Commissioner. I can foresee a network by radio which can carry not only broadcasting but also telegraphy, telephony, multiple communications, facsimile, television, and the like, all on one network and at the same time. I can see the possibilities of developing systems of inter-communication, both for sound broadcasting and for television, that will not depend upon wires at all, where you can carry these signals and these images by means of a radio line instead of a wire line or even of coaxial cables—by utilising radio relays.

CAREFUL LEGISLATION

And so it is important, it seems to me, that, in any appraisal of the problems of radio, that present-day limitations be not employed as the standard for to-morrow's Governmental regulations. The worst possible thing that could happen would be to put radio technique in a legislative strait jacket, because if that were done there would be a complete negation of the purposes of the Radio Act which in the very preamble refers to the development of radio to its maximum capabilities. I may not be using the exact language, but I am sure, to the sense of that language.

Those are the developments, Gentlemen, that I see in radio. I think they will come with greater rapidity now than they have come before, because, first, there is greater knowledge to-day about the radio art and industry than there was in the past, and second, there is greater necessity. The legend that "necessity is the mother of invention" still holds true. The best way to get additional networks functioning, the best way to get additional stations on the air, is not by taking from "B" what he has to-day and giving it to "A," who may want to go there, but by stimulating both "A" and "B" to carve out a new lane in the ether so that science, itself, may provide the opportunity for additional networks or additional stations. That can be done.

THE POWER OF WORDS

IT may not surprise those who use words in attempts to influence people that the power of words is amazingly small. While the physicist has not in this instance entered into the realm of propaganda, Dr. J. O. Perrine, of the Bell Telephone Laboratories, has computed for Phi Beta Kappa's quarterly, "The American Scholar," interesting figures upon the physical power of words:

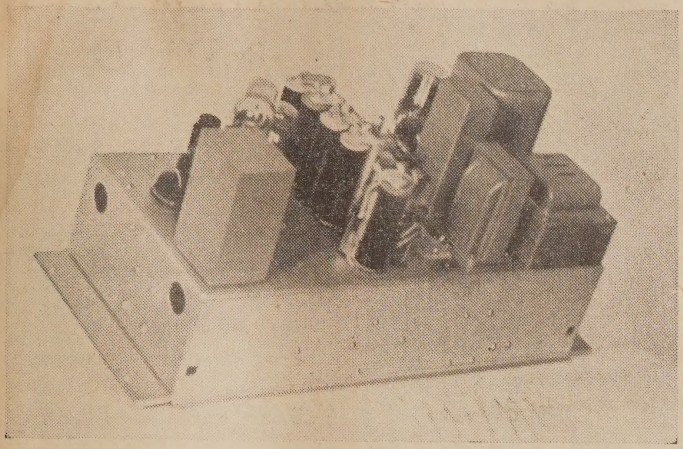
"The average power of words is one one-thousandth of one-millionth of a horse-power. As power this ought perhaps to be measured, not in horse-power but in gnat-power. But to analogise—if the heat power radiated from an ordinary Christmas candle could be properly distributed in minute amounts to speakers, in amounts proportionate to the 'power' of their words, 100,000 people could be kept continuously talking as long as the candle burned. Word power is almost the nadir of nothingness. When people whisper, the power of their voices is about one-hundredth of normal, when they talk loudly the power is 100 times greater, and when they shout their words yet another 100 times more powerful. The tones of musical instruments vary widely in their horse-power. The pianissimo of a violin may be one one-thousandth of a whisper; the fortissimo of an orchestra may be 10,000,000 times more powerful than the violin. The consonant sound 'th' as in 'thin' is one one-thousandth as phonetically powerful as the vowel 'a' in the college cheer 'Rah.'—"Science Service."

WHEN TRANS-OCEANIC RADIO WAS "IMPOSSIBLE"

IN 1913, seven years after his patent for the vacuum tube was granted, Lee de Forest was indicted on a charge of using the mails to defraud. In his attack the District Attorney remarked: "De Forest has said in newspapers and over his own signature that it would be possible to transmit the human voice across the Atlantic before many years. Based on these absurd and deliberately misleading statements, the misguided public, your Honor, has been persuaded to purchase stock in his company."

A. D. McFadyen, an examiner in the electrical division of the Patent Office, told this story to the National Electrical Manufacturers' Association recently, just to show that we are still as resistant to innovation as were our forebears, who thought that iron ships would sink and that the wheels of locomotives would spin on slippery tracks without getting trains anywhere.—Waldemar Kaempffert in the "New York Times."

BROADCASTING THE TIME SIGNAL



A general view of the unit.

NEW STANDARD FOR 2UE

In order to bring the radio time signal into line with that used in most British countries and in some European countries, a new sequence has been adopted in the transmission of the time signal from the Sydney Observatory.

THE time signal which has up to the present been broadcast hourly by 2UE, consisting of a dash followed by eight dots and a long dash, was one of the early wireless time signals adopted by Professor W. E. Cooke, who was Government Astronomer at the time, in the early 1920's.

THE NEW SIGNAL

The new time signal consists of six dots, which commence at 5 seconds to the hour and finish at the hour precisely. From a broadcasting point of view this is a definite improvement over the earlier type of signal, since it provides an accurate time signal, but at the same time causes a minimum amount of interference to the programme in progress.

Special new apparatus has been installed at the Sydney Observatory under the supervision of Mr. H. Wood, M.Sc., A.Inst.P., F.R.A.S., to provide a new type of time signal.

Warning signals, in the form of dots, are provided by the Observatory at times denoting 30, 20 and 10 seconds prior to the hour. These are not transmitted over the air, but are used at 2UE to set in operation a piece of automatic apparatus which is so arranged that it cannot be operated except by a series of three dots spaced 10 seconds apart and when so operated automatically injects a time signal into the programme. This piece of equipment requires no manual attention and may be described as follows:—

It consists of a rotary line switch and five telephone relays, which select and operate various circuits.

Two of the relays are provided with time delay circuits utilising gas discharge tubes to give delays of 9 and 11 seconds respectively. A resistar stabilised oscillator and amplifier w power supply, provides tone for t time signal and operating potent for the various circuits.

The first pulse, 30 seconds before t hour, operates the line switch, whi steps from position 1 to position 2, tur ing on a power supply and at the sar time setting in operation two time d lay circuits of 9 and 11 seconds.

As the next pulse comes 10 secon later, i.e., 20 seconds to the hour, is obvious that it will fall between t operation of the two time-delay rela which are set for 9 and 11 seconds. Tl circuit is so arranged that unless t succeeding pulses come within tl limits set by these circuits, no oper tion of the line switch takes place. Th precaution is taken to make the swit inoperative to false pulses, such as acc dental short circuit of the Observato line or adjustments to relays associa ed with the Observatory clock.

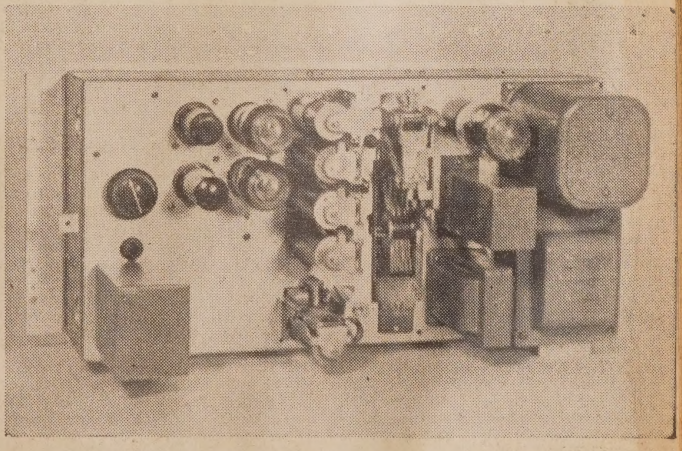
THE SECOND PULSE

When the second pulse comes at th correct time, it restarts the time-dela circuits from zero, preparing for th next pulse at 10 seconds to the hou which again operates the line switch causing another relay to be brough into operation, which is operated directl from the Observatory and applies th following six pulses to the studi equipment as a time signal.

After the last pulse, which denote the hour, the 11 second delay relay i allowed to function, since no furthe pulse comes 10 seconds later to preven its operation. This results in the os cillator and power supply being turne off and the line switch being returne to normal.

An additional circuit is incorporated

(Continued on Page 42)



The unit from above. Note the group of relays.

FEATURE STORY

BROADCASTING TO THE EMPIRE

A rack of receivers at La Perouse. On such equipment the overseas programmes are received, and relayed to broadcasting stations by land line.

HOW OVERSEAS B'CASTS ARE RECEIVED

Many people have expresed amazement at the extreme clarity of the re-broadcast transmissions from the London Short-Wave stations during the recent crisis. This article tells you how such excellent reception is made possible.

THE value of a reliable and thoroughly organised system of Empire broadcasting, as exemplified by the transmissions from the B.B.C., must have impressed itself on the minds of every listener during the last few weeks.

Since the development of the recent national crisis, which resulted in a declaration of war, we have been kept in close touch with England, and have received news of each development, straight from the heart of the Empire.

Gone are the days when we had to await the morning and evening newspapers for our news and information. To-day, we have such news brought to us in our own homes by means of the Empire short-wave stations.

EXCELLENT RECEPTION

Astonishment has been expressed in many quarters at the steadiness and clarity which have characterised every re-broadcast of the Empire station in practically every session which we have heard so far. Many radio sets have been unable to receive broadcasts from England direct, which, when relayed from a local station, have been perfectly satisfactory.

Naturally, the question is asked—Why should this be?

The answer is found in the special equipment used to pick up the programmes from Daventry. By comparison, the receivers and aerials used in our homes are particularly humble.

BEAM AERIALS

In the first place, the transmitters use "beam" or directional aerials, which concentrate the energy radiated from the transmitters along the direct path to Australia. This means a great increase in signal strength and the least possible loss of power through radiation in unwanted directions.

Naturally, the home receiver benefits from the use of such aerials at the transmitting end. But to obtain the full benefit one should use a similar type at the receiving end.

LA PEROUSE

The receiving station of Amalgamated Wireless at La Perouse is used for the reception of English programmes, to be rebroadcast by Australian stations.

At La Perouse there are huge receiving aerial systems of the directional type, which bring up the signal strength to an enormous degree. The net result would be something like adding several R.F. amplifiers to even the best receiver, and, even then, the same result would not be achieved.

With such aerials it is possible to obtain a useful signal, when, with a plain wire, scarcely anything would be heard above the noise level. When conditions are good, results are nothing short of marvellous.

The receivers used have been specially developed for this type of reception. They are all superheterodynes for these short waves, and are carefully matched to the aerial systems for the best possible results. Is it any wonder then, that, in competition with such an installation, the average dual-waver will often compare very poorly?

LAND-LINE LINK

The broadcasting stations which use these programmes are connected to La Perouse by means of the familiar land-lines, which feed the signal into the local transmitters. Thus the programmes from England go out on the air just as though they were coming from the local studio.

The part which radio will play during the trying times ahead will be all-important. It is good to know that, whatever should happen, we may depend on hearing about it through the marvels of short-wave transmission.

LATEST EMPIRE SCHEDULES

Just as we go to press, we learn of extensive changes in the times of operation of the various Empire transmitters, which are briefly as follow:—

Trans. 1: Over GS1, GSP, GSD, GSW, GSB, and GSE from 3.57 p.m. till 8 p.m.
Trans. 2: From 8.45 p.m. till 3 a.m.
Trans. 4A: From 3.17 a.m. till 6.15 a.m.
Trans. 4B: From 6.30 a.m. till 9 a.m.
Trans. 5: From 9.22 a.m. till 12.15 p.m.
Trans. 6: From 12.37 p.m. till 3.30 p.m.

All times shown above are Eastern Australian Standard Time. We would advise listeners, however, to watch for any further changes which may take place.

Frequency Modulation Next Year Says U.S.A. Specialist

The new type "frequency modulated" radio broadcasts will be filling the air in the major markets in this country within the next year, Dr. W. R. G. Baker, head of General Electric's radio and television division, predicted in speaking before a delegation of college and university professors.

Dr. Baker explained that frequency modulation is one of the latest and most promising developments in the field of radio, and makes possible, for the first time, practically static-free reception with a high fidelity that has hitherto been unattainable with the conventional "amplitude modulated" radio system.

"TWO frequency modulated transmitters are already operating," Baker said. "One is in Boston and another is in New York City. A third will be placed in operation here in Schenectady by early Fall."

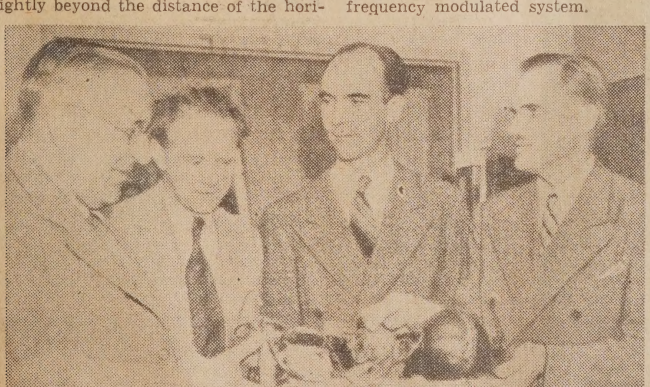
"Present receivers will not be able to pick up frequency modulated broadcasts, and it will not be possible to change them so they can," he said. "The public need not fear that present-day radios will be obsoleted immediately, however," he continued. "Amplitude modulated programmes will continue to be broadcast for some time to come. Frequency modulation will be sold to the public at the outset as another band on a new receiver, which will pick up both type broadcasts."

The frequency modulated system employs the use of ultra-short radio waves, and the signals broadcast travel only slightly beyond the distance of the horizon, according to Dr. Baker's explanation. This characteristic is said to be the open sesame for an almost unlimited number of broadcasting channels, with plenty of room for nation-wide chains and local stations galore.

Baker stated that frequency modulated transmitters could be built for approximately one-fourth the cost of the usual station, and that with the possibility of overcrowding the airwaves removed, many new broadcasters should crop up.

In describing the difference between the regular, or the amplitude system, and the new frequency modulated system, Dr. Baker explained that in the newer method the characteristics of the broadcast waves differ from the static, and, as a result, the frequency modulated receiver picks up the broadcast almost completely stripped of static.

In tests conducted earlier this year for a group of experts, including four from the Federal Communications Commission and three from the Interdepartmental Radio Advisory Committee, General Electric radio officials showed that 96 per cent. of existing static, both atmospheric and man-made, is eliminated from programmes broadcast under the frequency modulated system.



Four Nobel Prize winners recently attended a symposium on cosmic rays at the University of Chicago where they were the guests of Dr. Arthur H. Compton, who directed the symposium. The noted physicists are, from left to right: Dr. Victor F. Hess, professor of physics at Fordham University; Dr. Werner Karl Heisenberg, professor of theoretical physics at the University of Leipzig; Dr. Carl D. Anderson, California Institute of Technology, and Prof. Compton.

London Traffic Controlled By Loud Speaker

Scotland Yard's squad of traffic police have started a six months experiment in South London. Officers equipped with loud speakers on tripods, microphones, and control equipment are stationed at busy intersections and give advice to traffic.

"STOKOWSKY Has 'All-Electric Band'," read the newspaper headline of a U.P. report last month. It is believed that the great Leopold plans to have a 19-piece orchestra; with it he will tour Europe.

A ⅔-volt-filament midget tube will shortly make its appearance on the market! Two of these tubes connected in series may be operated from a single 1.5-volt. drycell with no more current consumption than for a single tube of 1.5-volt. rating.

Two radio-controlled, unmanned automobiles were sent into a head-on smash-up at full speed, last month, to test automobile bodies at the Morris Works (England), reported Practical and Amateur Wireless (London).

A lie detector was used for probing the case of alleged tampering with a colt at Belmont Park, U.S.A., recently, for the first time in racing history. Three grooms were double-checked by the device.

A MODERN *The* TECHNICAL
TREASURE FINDER

Often we are asked for a circuit of a "Treasure Finder"—apparatus for detecting precious metals in the ground. This extract from "Radio-Craft" will no doubt be of interest to such readers. We wish to state that we cannot guarantee results from this apparatus, nor have we any further details.

Here is the Treasure Finder as it is used in practice. It is slowly moved over the ground where the "treasure" is expected to be.

A SEARCHING study of all available data on previous treasure locators revealed that many limitations were imposed on these outfits by the lack of low-drain tubes, by the size and weight of "A" and "B" batteries, by low sensitivity, and in many cases the necessity of having to use hundreds of feet of wire and two or more operators.

Most of these limitations have been removed entirely from this newest treasure locator—see photo at upper-left

MODERN DESIGN

The instrument comprises 3 parts; (1) the receiver, (2) the transmitter, and (3) the framework. The receiver operates as a high-gain I.F. amplifier of 2 stages, with a tuned loop-antenna input. A diode detector and triode A.F. amplifier are used in the output with both phone and meter indicator. The 3 tubes are of the 1.4-volt filament type with a total drain of 150 ma. of "A," and only about 3 milliamperes of "B" thus assuring long life to the single drycell and the 2 light-weight, compact "B" batteries. The overall sensitivity may be varied and **at maximum is about 10 times greater than previous instruments of this type!**

The transmitter, consists of 2 drycell-type output pentodes connected in triode fashion and in parallel for greater power. Loop radiation and self-modulation combine to make a powerful and stable oscillator which is "easy" on the single "B" battery. Here, too, a single drycell serves to light the low-drain filaments.

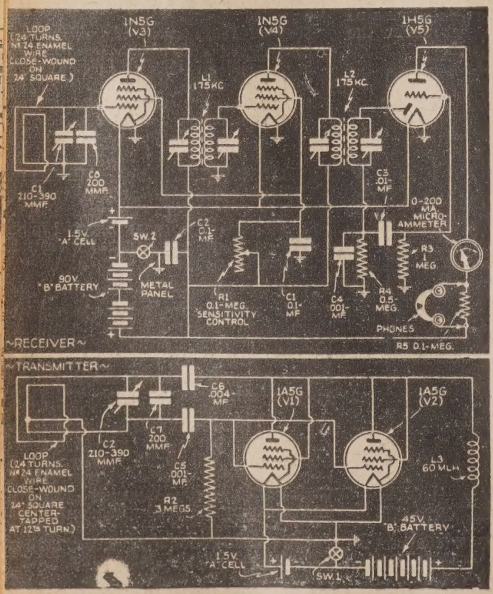
The framework consists of two 4ft. handlebars to which are attached the receiver and loop frame horizontally, at the front end, and the transmitter and loop frame, vertically, at the rear. The operator wears the headphones and watches the meter while carrying the unit about.

OPERATION

The principle of operation is simply that the radiated wave from the transmitter loop is directed into the earth and if the wave strikes metal, will be reflected up towards the receiver loop. Having picked up the reflected wave it is necessary to amplify it, demodulate it and indicate somehow its strength, usually by means of a milliameter in the output circuit or by observing the strength of the audio note in the headphones. In this instrument, both methods are used to ensure maximum accuracy.

The receiver and transmitter loops are mounted at exact right angles to minimise direct pick-up, so that when walking over ground which contains no metal there will be very little, if any, sound in the headphones, while the meter will show a steady high value of current. The moment the radiated wave strikes metal, however, the sound will increase appreciably and the meter needle will dip backwards to a lower value and possibly vary a bit.

The high sensitivity and directional properties of this outfit were demonstrated in the writer's shop during the initial performance tests when a metal tool-box lying on the floor was "detected" at a distance of 10 feet. By turning broadside to the box, the sound faded to inaudibility. In field tests, undertaken to determine the maximum depth of penetration, pick-up varied from 10 to 17 feet, depending upon the types of terrain.



Circuit diagrams for the apparatus. Top diagram is of the receiver. The transmitter is at the bottom.

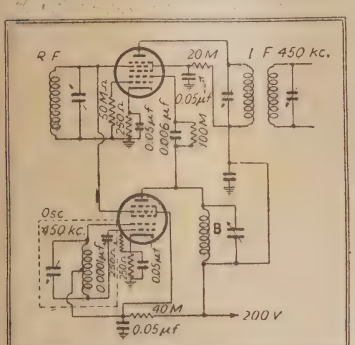
EDITOR'S WORLD REVIEW

Developments in other lands

CONSTANT FREQUENCY SUPERHET

Here is an explanation of a new idea in set building. Apart from the practicability of such a scheme, it throws an interesting angle on an application of the superhet. principle.

IN a conventional superheterodyne receiver, the frequency of the local oscillator is varied so that it is equal to the frequency of the incoming signal minus the frequency at which the intermediate frequency transformers



A suggested circuit for use with the constant frequency converter.

are designed to operate. In the receiver circuit described here, the frequency of the oscillator is kept constantly for all incoming signals and is numerically equal to the frequency at which the i-f transformers operate. The incoming signal is fed to the grid of the top 6A7 which is used as a mixer and also to the grid of the bottom 6A7 tube which is used as a frequency converter. The output of this latter tube is fed to the mixer grid of the first 6A7.

Thus, if f is the frequency of the incoming signal and 450kc is the frequency of the local oscillator, and if the i-f transformers also operate at 450-kc, then the frequency at which the incoming signal is finally converted is

f—(f—4950) equals 4950.

in which the quantity in the parenthesis is the operation performed by the lower 6A7 tube. It is evident that in the plate circuit of the converter tube there will be present the following frequencies:

(f—450), (f—450), 450,

and others of minor importance. The purpose of the tuned circuit (marked B in the diagram) in the plate circuit of the converter tube is to select only (f—450) so that this frequency only is fed to the mixer tube. It is also evident that the top 6A7 tube could be advantageously substituted by a 6L7 pentagrid mixer tube.

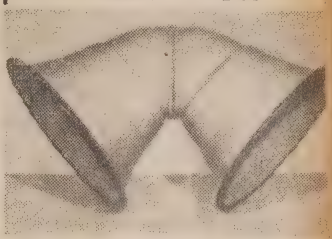
The advantages of this superheterodyne circuit are:—

(1) No troubles due to the inability of the local oscillator in the ordinary superheterodyne, to oscillate satisfactorily at the very high and very low frequencies;

(2) No frequent shifting of the tuning dial (due to frequency drift of oscillator) is necessary. If the frequency of the oscillator section of the lower 6A7 is controlled by a quartz crystal, this receiver's performance can be greatly improved.

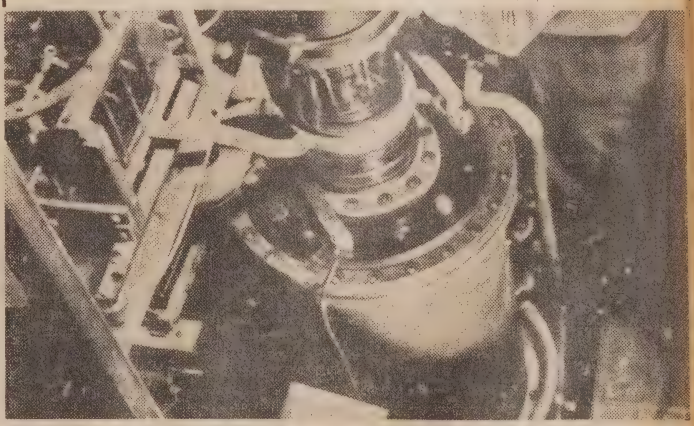
In the diagram, the details of the tuned r-f amplifier circuit and of the i-f amplifier have been omitted, since any conventional circuits will operate satisfactorily.—Electronics.

CONE SOUND PROJECTOR



A CONE sound projector to utilis the acoustic output of both sid of the cone speaker is an nounced by University Laborities, 1 Chrystie-street, New York. Increase efficiency and coverage are obtaine from the use of this unit. The place ment of the two halves is such that fan wave of sound is obtained (18 degrees horizontal and 90 degrees ver tical). Rubber tyre rims on the fron edges of both bells of the projecto eliminate resonance.

HIGH-POWER TRANSMITTING VALVE



600 kilowatts on short-waves: This 100kw. triode was designed by G. E. engineers for W2XAF. By the use of a directive antenna, the effective power in the direction of South America will be raised to 600,000 watts. The new valves are pumped continuously, and their construction permits replacing the filament in event of burnout or loss of emission. They are the largest demountable valves ever built in U.S.A.

The space behind the dummy pipes contains the chimes, microphones, and loudspeakers which radiate electronic organ music to the interior of the church. The equipment is housed beneath, as shown in this picture.

ELECTRONIC CHIMES FOR MAAS CATHEDRAL

So many things are now being done by electricity that we no longer express excessive amazement as each new marvel finds the news. This article gives some interesting details of the actual equipment used for electric chimes on a large scale.

THE electronic arts have made such tremendous contributions to economic and social life, and so much has been written concerning these applications, that we often fail to appreciate the advantages they provide in what we might term their more aesthetic applications.

An application which brings these thoughts to mind is an installation of church chimes recently made in an Eastern city where, in the space normally required by one good-sized bell, and at not much greater cost than one bell, the equivalent of a 21-bell carillon is obtained.

That no appreciable sacrifice in tone, timbre or volume is suffered is attested by the fact that not more than a handful of the population of that city is aware that there are no bells in the tower from which the sound emanates, and that during the first playing of the chimes congratulations poured in from points up to several miles distant.

COVERAGE

Coverage would perhaps be greater over level country. As it is, this church is located in a valley in the centre of a cup-shaped formation of hills about two miles in diameter, and, drawing its congregation from this valley, the voice of the chimes is more than adequate.

The installation employs a set of 21 tubular chimes, the output of which is picked up by uni-directional microphones and fed through an amplifier to a group of four heavy-duty loudspeakers mounted in the belfry.

The Maas Cathedral chimes are of the type employed in some orchestras and in many large organ installations. They are electrically driven and are played from a small keyboard mounted on the organ console. In fact they are a part of the organ installation, serving as the regular chimes common to better organs. The longest one is approximately five feet and they range in size down to about three feet. The striking mechanism is housed in the case at the top of the tubes.

THE CHIMES

The chimes, together with the two microphones used for pick-up, are mounted in the organ loft behind the dummy pipes shown in one of the photographs. This same space contains two of the loudspeakers which are a part of the Hammond organ, also an electronic device. It is this location of the chimes within the church proper that permits them to serve both as a part of the organ (heard directly by the congregation) and as outside church bells.

The number, type, placement and mounting of the microphones calls for a considerable amount of skill on the part of the installation engineer, as the conditions encountered in different locations vary greatly, with the result that there is no "rule of thumb" that can be followed.

REQUIREMENTS

First, the pick-up must be such that all chimes are reproduced in proper proportion.

Second, there must be ample pick-up, yet not enough to introduce extraneous sounds, acoustic feed-back, &c.

Third, where the chimes compartment is closed or partially closed there must be complete avoidance of anything like cavity resonance; or where the chimes are mounted in the open, any undesirable characteristics of the room must be offset. In this installation two crystal microphones are employed with some acoustic deadening in the semi-open chimes compartment and with extensive baffling around the microphones.

The amplifier is a high-output sound system capable of delivering 250 watts. It is custom-assembled to specifications and provides not only the high output required for this purpose, but likewise the wide flexibility.

MIXING SYSTEM

The two microphones feed into individual 6J7 preamplifier units. These in turn work into an electronic mixer unit, work into an electronic mixer unit, utilising only two of its five channels and leaving three as a reserve for later expansion if desired.

This mixer unit also includes a triode-connected 6J7 voltage amplifier stage which works out of the paralleled plates of the mixers, each of which is connected into an isolating network that presents a low-distortion load and thus effectively eliminates non-linear distortion resulting from the usual direct parallel connection of tube plates.

The two 125-watt main amplifiers have their inputs connected in parallel. Each of these consists of a 6C5, a pair of 2A3's as a push-pull driver, six 809's on push-pull-parallel as the output

stage, and its own power supply utilising a pair of 83's. Each also has its own gain control so that the two groups of speakers may be operated at different levels if desired.

This amplifier system is also located in the organ loft. Each main amplifier feeds two speakers through 500-ohm lines which are run through conduit and BX to the speaker platform in the tower.

SPEAKERS

Here the speakers are mounted, facing in four directions to correspond with the large windows which constitute the vertical central panels of each tower wall. The speakers are each designed to handle 35 watts continuously and much higher power on surges.

An interesting and advantageous feature of this installation is the fact that down on the street in the immediate vicinity of this church the chimes are by no means uncomfortably loud. Presumably due to the foresight of the architect who designed the tower (it was originally intended to hang standard bells), all openings in the tower walls are such that the sound radiates principally in a horizontal plane.

DIRECTIONAL HORNS

The use of directional, horn-type loudspeakers enhances this effect, with the result that the sound intensity on the ground at distances up to a half-mile or so is substantially uniform. Beyond this distance the level falls off gradually, but on the surrounding hillsides, a mile or more distant, it is still well up. Had the belfry been one of the type with louvres, the peal of the chimes would have been little short of deafening in the immediate vicinity, and their distance range would have been severely limited.

This installation, which was designed and made by Francis J. Rybak and Company, New York City, specialists in organ installations and electronic applications in music and sound reinforcement, suggests a solution of the problem of the empty bell towers in many of to-day's churches.

LOUD-SPEAKERS FOR BELLS

The sound is projected horizontally from the belfry to give substantially uniform sound intensity at ground level over a large area.

With so many other uses for such funds as they may have at their command, many modern churches, architecturally designed for large chimes installations, have had to be satisfied with a modest arrangement of two or three bells, or perhaps none at all. Yet a properly designed system of amplified chimes such as that described here could be installed at a cost insignificant as compared with that of a set of bells providing equal tone range and output.

HIGH-VOLTAGE FILAMENT VALVE

A move towards popularising high voltage filament valves may be anticipated by "Hygrade-Sylvania," which American firm announces a new full wave rectifier with 117v. filament.

Each of the two plates has its own cathode and filament, as usual, and also as usual the two filament sections are connected in parallel, but each filament section is centre-tapped. The centre-taps of the filaments are brought out to pin No. 1 so that it is possible to operate the filaments in parallel on 58.5 V. With this connection, the heater current is 150 milliamperes, whereas when operated on 117 V. it is only 0.075-ampere.

This matter of obtaining sufficient resistance to achieve this low current drain at such high terminal voltages, and yet secure sufficient filament heat to assure adequate cathode radiation, presented a problem which required an entirely new manufacturing procedure.

The solution was eventually found in the construction. A high-resistance filament, heavily insulated to withstand breakdown at the peak voltages which might be encountered under all types of operation (as for instance operating the tube on the "high" side of a three-wire power system having possible peak voltages-to-ground in the region of 450 V.), is folded back and forth to make a bundle of 15 folds, centre-tapped. Two such filament bundles are then slid into emitter-coated metal cathodes; the usual ceramic cathode is not needed, since the filament wire is insulated. This filament insulation is obtained by a special process of eight alternate immersions in a solution and of baking this chemical on to the filament wire.

The serviceman encountering one of these 117Z6G's for the first time, and closely examining it, would ordinarily get the (erroneous) impression that the filament is shorted upon itself at every fold, and that the filament is shorting directly to the metallic-tube cathode. The answer is that, as described above, the filament is an insulated wire.

Conventional rectifier circuits may be employed, but care should be taken to insure that the maximum current and voltage ratings are not exceeded.

STEREOSCOPIC TELEVISION

IN a short article on the "Problem of Stereoscopic Television," in the Jan., 1939, issue of the "Telegraphen und Fernsprech-Funk und Fernseh-Technik," Manfred von Ardenne writes on the relative qualities of stereoscopic television and ordinary "flat" television pictures. He points out that to obtain an equivalent "stereo" picture requires twice the frequency band-width of a normal black-and-white picture. For an equivalent number of picture elements per second and for the same frequency band-width the stereoscopic picture corresponds in sharpness to a normally flat picture of half the number of picture elements.

The study was conducted along the lines of a previous experiment by the author in color technique. For the normal two dimensional picture was substituted a stereo picture of the same subject having half the number of picture elements.

ABOUT GERMS

Because the tiny little chaps we all "germs" have such unfortunate effects, we are apt to consider them a poor subject for cheerful examination. And yet they are members of our marvellous natural structure, just as truly as we are ourselves. Their discovery was one of the most important events in medical and biological science.

By
CALVIN WALTERS

Colonies of bacteria growing on a plate of media. Note different sizes of colonies. This feature, together with color and effects on the media, help to differentiate between different bacteria.

ONE of my pet hobbies a few years ago was messing around with germs. You know, germs are interesting little things. So small and delicate and dainty. So full of life. And don't they cause some troublesome things to happen everywhere?

Think of all the unemployment that would abound if there were no germs. No doctors, dentists, nurses, chiropractors, pathologists, naturopathic quacks, health inspectors, patent medicine, hernalists, bad meat, sour milk, hospitals, chiropodists, etcetera.

One of the best ways I know of getting a seat in a crowded train is to pull a test tube out of your pocket and announce in a loud voice to your friend, "Typhoid germs." Most effective. Of course, everyone is not in the fortunate position of being able to collect a test tube full of germs, so, of course, the above seat-getting method is only available to the favored few.

FASCINATING BUT DANGEROUS

To leave joking aside, this study of germs is a most fascinating one, but is rather too dangerous to be indulged in generally. Fortunately, it is also rather expensive, so making it beyond the means of any but the wealthy. This does not infer that I am, or was, wealthy. My introduction to the germ world was through my employment. I might add that a germ put me out of the job, also. One of them became a little too friendly, proving to me that they cannot be treated with contempt.

Germs take on many forms, but the two most general are the coccus and the bacillus. A coccus under the microscope appears as a round or almost round cell, while a bacillus is shaped like a rod.

Some of the troubles of mankind caused by the coccus are pneumonia, boils and carbuncles, blood-poisoning, and meningitis.

The bacillus seems to be the cause of most of the serious diseases, such as tuberculosis, diphtheria, typhoid fever, tetanus, leprosy, anthrax, cholera, etc. So you see that, if you must harbor a germ, don't let it be a bacillus if it can be avoided.

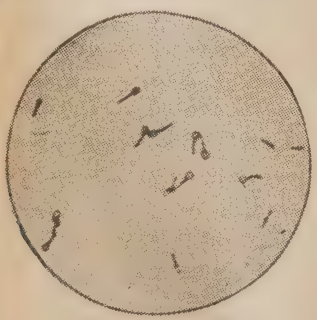
Bacteria which include all germs generally are so small that they are measured in terms of microns. A micron is .001 millimetre, or one-thousandth of a millimetre. Most germs are from one-half to four microns in diameter or length. Rather tiny.

BACTERIA PROPAGATION

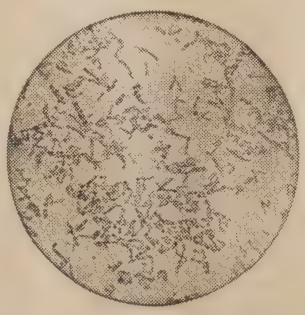
The propagation of bacteria is a most interesting process. When a cell has reached its maximum size for its species, it elongates and forms a "waist" round the middle. This "waist" then divides, and two cells are thus formed from the mother cell. This process again takes place with the two new cells after reaching maximum size, and we have four cells. This is continued as often as once in every twenty minutes under favorable conditions, which throws some light on the difficulties encountered in the treatment of disease.

In these days of vaccines and immunisation it may be as well to follow the process of making a vaccine. The method varies with the particular disease to be treated, but for most of the common troubles the following is generally that used.

Some of the germ-laden material is



Tetanus bacilli showing end spores, commonly called "Lockjaw" bacilli.



Bacillus of diphtheria (magnification 1000).

placed on a glass plate containing what is called media. This media is usually a mixture of agar, a kind of gelatinious substance obtained from East Indian seaweeds, and beef broth, salt, etc. The plate is rubbed over with a sterile glass rod, covered, and placed in an incubator, which is kept at a constant temperature of 37 degrees Centigrade. After a period of about 12 hours the plate is seen to be covered with a number of spots about the size of a pin head.

COLONIES

These are called colonies, and comprise enormous numbers of bacteria in each colony. The color, size, and number of the colonies usually determine the kind of bacteria causing the particular disease.

A number of test tubes are now taken, containing a quantity of the same jelly-like media used in the first instance. One of the colonies on the plate is now touched with a sterile platinum wire, and the wire is rubbed over the surface of the media in the test tube. Several colonies and test tubes are treated in this way, and the tubes placed in the incubator.

The active bacteria are thus isolated from any others that may be present and unimportant, and after a period of twelve hours or so the test tubes will contain pure culture of the virulent germ.

Having now secured our "bugs," a small quantity of sterile salt solution is now poured into each tube, and the germs detached from the media by rubbing the surface with a platinum wire. This forms a milky emulsion, which is diluted to a strength suitable for administration with sterile salt solution suit containing .5 per cent. carbolic acid. The resultant vaccine is then sterilised by heating in a water bath at a temperature of about 60 degrees Centigrade for an hour or so.

VACCINE

This then is a vaccine. There has been a lot of argument among the uninformed about this method of treating disease. Most of the arguments seem to be founded on the ground that it is "filthy" and unnatural.

Well, it is filthy and unnatural to have live germs in our bodies, so I don't suppose it is any worse having dead ones injected to get rid of the live ones.

Vaccines are principally used to counteract the effects of a specific germ that has entered the system, and are made from that particular germ. The vaccine may be administered as a protection in anticipation of exposure to an infection or as a curative when exposure and infection have taken place.

Vaccines act by provoking the formation in the blood of antibodies which neutralise the toxin or poisons produced by the germs. This method of treatment is called vaccine therapy.

There is another method called serum therapy. This is distinct from vaccine therapy inasmuch that instead of injecting into the blood stream dead germs, a serum is used instead. If an animal is subjected to repeated injections of a living organism the blood gradually acquires an increasing resistance to that particular germ.

The blood attains an immunising power that is transferable to another subject. After a certain period of injections of the organism a quantity of

Above: Streptococcus pyogenes. Below: Baccillus anthracis. Note the round appearance of each coccus in the chain, as distinct from the rod-shaped anthrax bacillus.

blood from the animal is taken and allowed to clot. During the process the serum separates from the red blood corpuscles and it is this serum that is used to inject into the blood of a person suffering from a disease of which the serum is specific.

Don't turn up your nose at this. After all what is the difference between eating an underdone steak from an animal of which you know nothing and having an injection of blood serum from an animal that has suffered only from the same disease as you have when you have the injection.

And believe me, when I say that before an animal is treated for serum making purposes, it is put through a rigid test far surpassing that at any abattoirs to make sure it is absolutely healthy.

Of course, all bacteria are not disease producing. Some of them are really friendly. Take, for example, the little chap by the name of Saccharomycetes. No, it is not an Indian Rajah, but merely a little "wog" by the name of yeast. He is responsible for the fermentation in beer. He is divided into various varieties and gives a good, bad, or indifferent beer, according to his variety. He is a most popular fellow.

Then there is one called Mycoderma Aceti, which sounds like some kind of ornamental shrub but is not. It is an oxidising agent consisting of two kinds of bacteria. These ferment beer and make vinegar out of it. What a waste!

The hair is removed from hides in the tannery by means of bacteria, which cause the hides to putrify. A visit to a tannery with your gas mask off will prove the truth of this statement.

Cheese is manufactured with the aid of bacteria. Here again, like beer, the kind of cheese you get depends on the kind of germ you use. Different germs seem to exist in various parts of the world which make different cheese. For example, there is a germ in Germany (that is real good, don't you think?) called by the simple name of Penicillium Glaucum, which is responsible for Gorgonzola cheese and Stilton.

COLORING GERMS!

An interesting side of bacteriology is the various methods of using analine and other dyes to stain the bacteria for identification. Bacteria take up the basic analine dyes very readily. One of the most common methods is as follows:

The suspected substance is rubbed on a glass microscopic slide, and after drying a solution of specially prepared Gention Violet is poured on the slide. This is then poured off, and a solution of iodine is poured on. This is again poured off, and the slide washed in alcohol. A solution of Eosin, a red dye, is then poured on, and the slide dried.

Examination under the microscope will show the bacteria stained, some perhaps with the violet, and some with the red. The shape of the organism can be clearly seen and identified by its color and formation. Some bacteria are fitted out with swimming apparatus which takes the form of fine hairs arranged around its body, called Flagella. They are capable of extremely rapid motion, and fly past the lense of the microscope in world champion fashion.

Space will not permit of a description of the wonders of germ life beyond what has been described. Books without number have been written on the subject, and no astronomer with his stars gets more amusement than a bacteriologist with his "wogs." Always remember that, no matter how many germs you are suffering from, someone can get some fun out of it.

WHEN YOU ARE CUTTING ROD OR TUBE

Tube and particularly glass tube is very difficult stuff to handle, but if this little hint is adopted you will find the job much less difficult.

Take a piece of wood slightly longer than the jaws of your vyce, and down the centre drill a hole the same diameter as the tube to be cut, then cut the piece of wood down the centre. When the tube and wood are placed in the vyce, you will find the tube will be firmly held without fear of breakage.

An elementary

COURSE IN RADIO

for beginners

Being a very elementary course of Radio study for those who wish to know "what makes the wheels go round."

By L. B. GRAHAM, Principal of the Australian Radio College, Pty.,

CONDENSERS FOR RADIO RECEIVERS

A pair of modern electrolytic condensers which, although bearing the full rating of larger types, are very much smaller. These condensers are used for filtering out the main power supply for the set.

A CONDENSER consists of any two conductors of electricity which are separated from one another by some form of insulation. The conductors are known as the "plates" of the condenser, the insulation as the "dielectric."

In radio receivers we find many condensers of various types which have certain work to perform. In addition we find many undesirable condensers which have an adverse effect on a set's performance. Most of the undesirable condensers consist of stray capacities between long wires and metal parts which are close to one another and separated by air or some other form of insulation. It is to keep these undesirable capacities to a minimum that it is necessary to make many of the wires in a receiver as short and direct as possible. This applies particularly to the grid and plate leads of any valves. Shielding is also necessary around valves, coils and other parts to reduce undesirable capacities to the lowest possible value.

In this article, apart from stressing the necessity for keeping the plate and grid leads of tubes as short and direct as possible and for efficiently shielding valves and coils, we will not deal with stray undesirable capacities, but will concentrate on the construction and operation of condensers which serve a useful purpose in a receiver.

TYPES OF CONDENSERS

There are four principle types of condensers employed in receivers, the differences between them being determined mainly by the type of dielectric material or insulation between the plates. The most commonly used dielectric materials are air, mica, paper impregnated with wax and, in electrolytic condensers, a thin film of aluminium oxide.

AIR DIELECTRIC CONDENSERS

Condensers employing air as the dielectric material are very efficient, cause little loss of energy and are very suitable for use in circuits handling high radio frequency currents. The most common application of this type is the ordinary tuning condenser, which consists of a number of interleaved metal plates separated from one another by air. Trimmer condensers, which are used for adjusting the tuning of a set when it is first constructed, are of the air dielectric type in a number of the newer receivers.

Air dielectric condensers are only available in small capacities, due to the fact that the plates have to be fairly well separated to prevent any possibility of their touching.

The capacity of this type ranges from a few micro-microfarads up to about 500 micro-microfarads or .0005mfds.

MICA DIELECTRIC CONDENSERS

Where a small capacity condenser of an efficient type is required and it is not necessary to be able to change the capacity, as in the case of tuning condensers, one with a mica dielectric is generally chosen.

Mica is a mineral substance which is used in thin transparent sheets, something like thin celluloid. It is an extremely good electrical insulator and a condenser using it as a dielectric will operate efficiently even at high radio frequencies.

Mica condensers are usually made up of a number of thin metal plates interleaved with thin sheets of mica as shown in Fig. 1. The plates are made of thin brass or tin foil and each alternate plate is connected together, so that we have two separate groups of plates. Mica condensers are made in size from about .00001mfd. up to .01mfd. Where a small capacity is required, only two plates would be necessary, but for larger capacities, there may be 40 or 50 plates used, each separated from those on either side by sheets of mica.

DIELECTRIC CONSTANT

If we have an air condenser with a certain capacity and we replace all the air, from between the plates, with mica, without altering the condenser in any other way, we would find that the capacity with mica as the dielectric

would be about five times as great as when air was used. This property of mica of increasing the capacity compared with air is known as its "dielectric constant," or some people call it the "specific inductive capacity." We would say that air has a dielectric constant of 1 and that mica has a dielectric constant of 5.

Here is a list of the dielectric constants of various materials, which are sometimes used as condenser dielectrics. The actual values vary with different samples of the same material and with different temperatures.

MATERIAL	DIELECTRIC CONSTANT
Air	1
Aluminium oxide	About 10
Glass	4—10
Isolantite	3.6
Mica	3.5—7
Oils	3—5
Paper (Waxed)	2—2.5
Quartz	4.5
Rubber	2—3.5

WAXED PAPER CONDENSERS

Mica is a comparatively expensive substance and it would not be economical to construct condensers with a capacity larger than .01mfd. with mica. For larger sizes, up to 4mfds., a dielectric material, consisting of paper impregnated with wax, is generally used. The dielectric constant of this paper is about 2.5, but its low cost more than makes up for the quantity which has to be employed.

Instead of a number of small interleaved rectangular plates, it is more convenient to use two long strips of tin or aluminium foil, about 1½ inches wide 3-10,000ths ins. thick and long enough to provide the desired capacity, separated by one, two or three thicknesses of waxed paper and drilled up into a compact roll. This construction is indicated in Fig. 2. The edges of the plates overlap the paper, one at one end of the roll and the other at the other end. These overlapping edges are pressed together and a connecting lead is soldered to or pressed against each end.

The efficiency of paper condensers is quite good and they perform very well at audio frequencies or at ordinary radio frequencies used by broadcasting stations. At the very high frequencies used by short-wave stations, they do not work so efficiently, and it is best to use mica condensers at these frequencies.

ELECTROLYTIC CONDENSERS

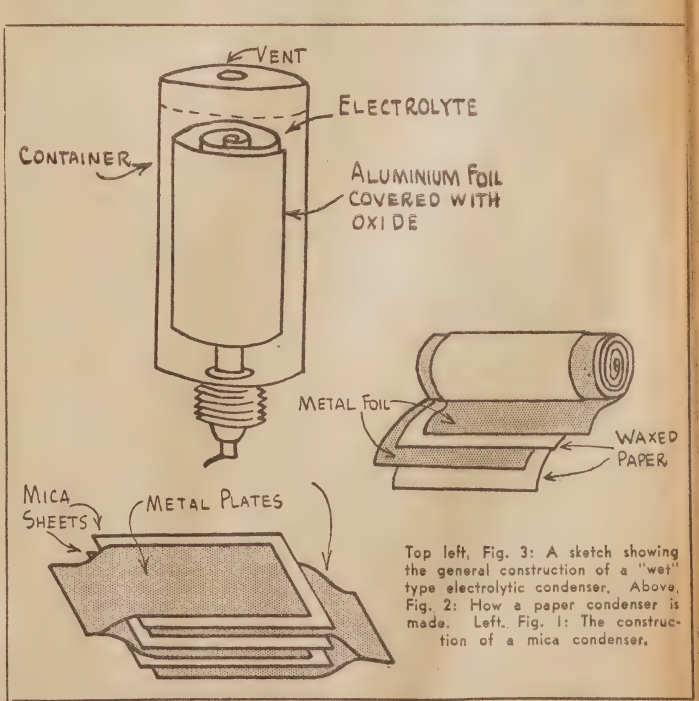
Electrolytic condensers are the most interesting of the various types. There are two different methods of making these condensers, one is known as the "wet" type, while the other is known as the "dry," or "semi-dry" type.

A wet electrolytic condenser, consists of an outer aluminium can which contains a liquid, usually a boric acid solution, which acts as one of the plate. The other plate is a sheet of extremely pure, thick aluminium foil, mounted on an aluminium rod, which holds it in place in the liquid, and also acts as the connection to the foil.

During the construction, a high D.C. voltage, usually about 500 volts is applied between the foil and the liquid. The positive terminal of the supply is connected to the foil, while the negative terminal is connected to the outer container holding the liquid. At first a current flows between the foil and liquid and this causes a chemical action to take place, releasing oxygen gas on the surface of the aluminium. The gas causes a thin film of aluminium oxide to form on the surface of the foil and as this oxide is an insulator, it gradually insulates the foil from the liquid surrounding it, so that the oxide acts as the dielectric, while the foil and liquid act as the condenser plates. As the oxide only forms on the foil when the foil is posi-

(Continued on Page 35)

A group of tubular and mica condensers. These are made with either lugs or pigtail connections, according to requirements.



Top left, Fig. 3: A sketch showing the general construction of a "wet" type electrolytic condenser. Above, Fig. 2: How a paper condenser is made. Left, Fig. 1: The construction of a mica condenser.

RADIO-FREQUENCY COIL DESIGN

☆ *applied to receivers*

This article presents a summary of the main factors which must be considered when working out the design of tuning coils. Much has been learned since the early days of simple solenoid coils, and the improved performance of the modern set largely rests upon them: Nowadays, a tuning coil is a highly efficient and specialised piece of apparatus.

By
E. M. FANKER
Chief Engineer, Thom & Smith

T may well be said that the tuning coils are the heart of the radio receiver. In fact, the ultimate performance of the entire receiver is to large extent tied up with the attenon paid to the design and construcon of these components.

The quality of the coils used governs ree of the main factors in a receifer, amely, sensitivity, selectivity, and staility.

The formulas governing the tuning uge of a coil are well known and nder the control of the design enineer, but research and experiment is continually going on in an endeavor to reduce the electrical losses in these components and improve their general performance.

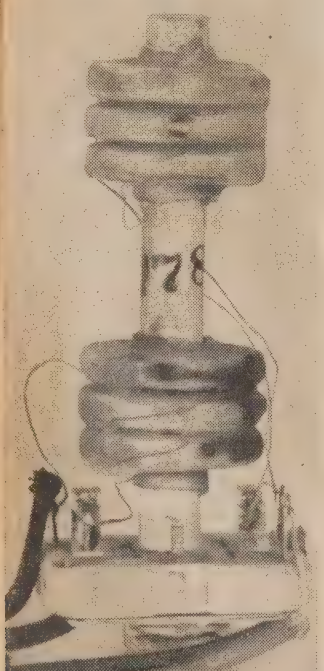
It would be extremely difficult to say how many different sizes and shapes of tuning coils have been evolved since the inception of radio, each having some particular feature or function, and the day when a standardised type of coil will come into general use still seems very far distant.

Types of tuning coils used in a radio receiver may be classified as follows:—

(a) Aerial Coil. This is used in every type of receiver and still constitutes one of the designers' biggest problems.
(b) Radio Frequency Transformer. One or more are used for each stage of radio frequency amplification employed.
(c) Oscillator Coil. Used generally in superheterodynes.
(d) Intermediate Frequency Coil. Two or more generally used for each stage of intermediate frequency amplification.

Where more than one tuning range is employed in a receiver, additional a, b, or c will be required for each additional tuning range.

This is not the case with d, except in highly complicated and elaborate receivers.



An intermediate transformer showing the "pie-wound" construction of the coil. The coils are trimmed by the small condensers in the base.

COIL DEVELOPMENT

It is interesting to trace the development of the aerial coil from the early single slide tuner to the present-day high efficiency litz-wound coil, having a core of high frequency iron or other magnetic material.

We have had, in turn, loose couplers, variometers, vario-couplers, honeycomb coils, solenoid coils, spider webs, basket weave, and bank wound coils.

The early coils were usually of large proportions and wound with heavy, solid copper wire, but the introduction of ferro-magnetic materials, consisting of finely divided particles of iron, separated from each other and combined together with a suitable insulating binder, has resulted in the development of highly efficient coils of very small physical proportions.

While the use of this core material has brought about a considerable improvement in the efficiency at broadcast and intermediate frequencies, there seems to be little benefit from its use on short-wave, other than ease of adjustment of the inductance of the coils in production.

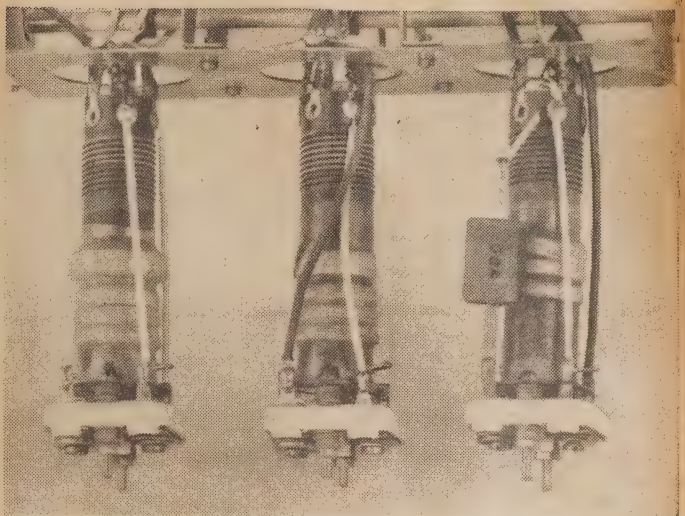
This is not hard to understand when one considers that the introduction of the powdered iron core raises the effi-

Another "pie-wound" intermediate. Note the method used to keep the leads fixed in the position relative to one another.

ciency of the coil by reducing the amount of copper wire required for a given inductance, and, as the amount of wire required in a short-wave coil is usually so small, the losses brought about by the introduction of the core more than offsets the benefits derived from the reduction of the copper wire.

The aerial coil not only serves as a medium for tuning the receiver to the desired frequency, but also acts as a transformer between the aerial and the grid of the 1st valve, and it is due to the widely varying conditions under which it is used that it is not possible to design a coil that is suitable for every set of circumstances.

The secondary winding of the aerial coil serves to determine the tuning range of the receiver, and the losses in this coil should be reduced to the lowest possible amount. The aerial may be coupled to the secondary winding either by inductance or capacitive means. In the first case, a separate or primary winding may be used or a tap made on the secondary coil, in which case it becomes an auto transformer. Capacitive coupling may be by means of a small condenser at the high potential end of the coil or a large condenser at the low potential end of the coil, or maybe combined with inductive coupling as well.



What's inside a dual-wave coil unit. Aerial, R.F., and oscillator coils for broadcast and short waves are wound on the same former. The trimmers for each are mounted on the bases—adjustment being made through the top of the cans. The leads run down to the wave-change switch below.

PRIMARY WINDINGS

The type of aerial to be used governs to a large extent the suitability of the different types of primary windings

Where a few turns only are used, the primary is known as the low impedance type. This usually resonates outside the high frequency end of the tuning range, and suffers from the disability that the amplification falls off considerably towards the low frequency end of the band.

A high impedance primary usually consists of a larger number of turns and resonates outside the low frequency end of the band when connected to the normal aerial and ground.

A primary having an inductance such that it resonates within the tuning range of the receiver is capable of giving considerably increased amplification over the other types, but requires very critical adjustment of coupling to prevent serious misalignment of the secondary and losses caused by coupling the aerial resistance into the tuned circuit.

HIGH-IMPEDANCE PRIMARIES

Generally speaking, high impedance primaries are most desirable, as they give considerably increased gain when used with short aerials, and, while a low impedance primary may give better results when used with a long aerial, the greater signal pick-up of this may prove, in many cases, to be more of a curse than a blessing.

The tuned circuit employed to couple the radio frequency valve to the following valve may consist of a coil similar to that used in the secondary of the aerial transformer, and the plate of the first valve may be coupled to the grid of the second valve by either inductive or capacitive means

With screen grid valves it is desirable to obtain as high an impedance in the plate circuit of the radio frequency valve as possible without coupling the plate resistance of this valve into the following tuned circuit. This is probably best effected at broadcast frequencies by using a high inductance primary winding of a value such that it resonates just outside the low frequency range of the receiver when combined with the valve and other circuit capacities.

At high frequencies, however, it appears more desirable to have the primary resonate somewhere in the tuning range. This results in a much higher impedance load being presented to the plate of the radio frequency amplifier valve, and the damping of the tuned circuit is not so important, as the plate resistance of the RF valve is generally much higher at these frequencies than the input conductance of the following one.

CAPACITIVE COUPLING

Capacitive coupling as used in the tuned anode method is not generally favored, as the value of the coupling capacity required varies greatly with the frequency of operation. However it is sometimes desirable to allow a small amount of capacitive coupling when using high impedance primary coils in order to increase the amplification at the higher frequencies.

The polarity of the windings is extremely important where any capacity couplings exist, and if this is incorrect a considerable drop off in amplification will be noticed towards the middle of the tuning range.

OSCILLATOR COILS

Oscillator coils are relatively simple to design, the main problems here being stability and uniformity of output voltage.

Solenoid coils wound with solid wire spaced by an amount at least equal to half the diameter of the wire appear to be the best from the point of view of stability.

The use of silk or cotton covering should be avoided, as this absorbs moisture from the atmosphere, and changes the distributed capacity of the coil.

Uniformity of output may be obtained by using suitable oscillator circuits, and particularly in the case of short wave coils, by taking steps to ensure that the greatest possible amount of the inductance in the tuned circuit is concentrated in the coil itself.

It is as well at this stage to point out that the inductance in the circuit comprises all the wire between one set of plates in the tuning condenser and the others.

All leads should be made as short and direct as possible; the grid of the valve should be taken direct from the stator plates of the condenser, and the low potential end of the coil should be taken direct to the wipers contacting the rotors of their particular condenser section.

WITH A.V.C.

If automatic volume control is applied to the coils the by pass condensers should go direct to this point, as should also the padder used in the oscillator circuit. If this is not done the different tuned circuits will quite probably be coupled together through the chassis of the receiver.

The use of stranded insulated conductors, generally known as litz wire, is of great advantage in obtaining efficient coils at broadcast and intermediate frequencies. The use of this kind of wire reduces the losses due to eddy currents which occur in solid conductors, and it

important to see, when using litz wire, at none of the conductors are broken any point in the coil, and that they make good electrical contact at the art and finish.

The use of litz wire for short wave ils is not to be recommended, as at ese high frequencies skin effects ap- ar to concentrate the currents on the tside of the conductor, and for this ason solid wire appears to be the most referable.

Diaelectric losses in the insulating aterial separating the turns of a coil ave a great bearing on its perform- ice, and it is necessary in designing coil to use a minimum of insulating aterial of the highest quality obtain- ble for this purpose. Air spaced coils aturally have the lowest losses.

Various types of winding have been volved to achieve this end, and also to educe the distributed capacity of the oil.

ISTRIBUTED CAPACITY

Distributed capacity may be express- d as the sum of the capacity existing etween the individual turns of the coil, nd it is important that this be kept to s low a value as possible.

The relative merit of a coil may be efined as the ratio of its reactance to ts resistance, and is given the term by adio engineers of "Q." All good design aboratories make use of an instrument o measure this factor, which usually consists of a calibrated oscillator, which s coupled, by means of a small resist- ance of known value, into a tuned cir- uit comprising the coil under test and a variable condenser of very low losses. A vacuum tube voltmeter is connected across the tuned circuit, and this is calibrated in terms of Q.

By means of this instrument it is possible to quickly determine the effect of any alterations made in the design of a coil, as well as its inductance, dis- tributed capacity, and so forth.

Another great advantage of this in- strument is its ability to quickly deter- mine the effect of any shield can used in conjunction with the coil under test.

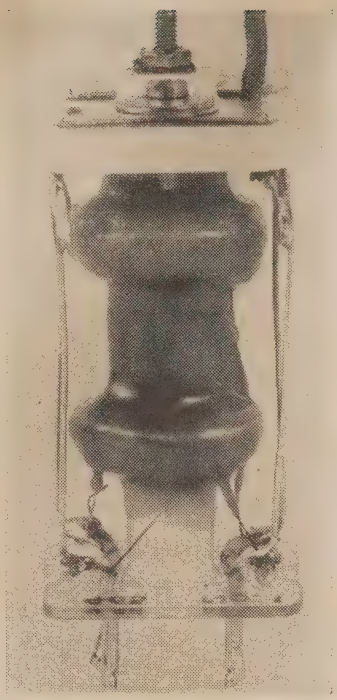
The coils used in the intermediate transformers are almost invariably honeycomb wound, and in a number of cases are divided up into pies or sec- tions, and may or may not have a core of ferro-magnetic material.

IRON CORES

In addition to improving the per- formance of the coil, this core may be used to vary the inductance of the coil, and, in conjunction with fixed con- densers of high stability, to tune the transformer to the desired frequency.

Coils employing these iron cores are capable of giving greater gain and sel- ectivity than those using air core, but it is essential that the components asso- ciated with them be of a very high degree of stability, otherwise the benefit gained by their use will be more than offset by the circuit becoming out of alignment.

In some cases it may not be desirable to use coils having too high a value of Q in the tuned circuits of an intermedi- ate amplifier, particularly if these are coupled close enough to pass a band of frequencies.



A modern intermediate wound on a trolitul former. Note the wax coating on the coils—the coating does not penetrate the winding. The "bird-cage" construction keeps the coil leads in place within the can. This transformer uses iron cores, and has mica trimmers.

HIGH-Q COILS

Use of high Q coils in these circum- stances may result in a resonant curve being obtained, having two distinct peaks and causing serious distortion in the receiver.

In order to obtain a satisfactory band pass transformer, free from these twin resonant peaks, it is necessary to intro- duce some resistance into the tuned cir- cuit, which in turn considerably broad- ens the skirt of the selectivity curve. The only practical way to overcome this is to add additional tuned circuits, and, as it is not always desirable to add addit- ional values to the intermediate fre- quency amplifier, transformers have been evolved which employ three separate windings, namely, a primary, which is connected to the plate of the preceding valve, a secondary which is connect- ed to the grid of the following valve, and a tertiary winding, which is located half way between the two, one side of which is normally grounded.

The permeability tuned type of inter- mediate in which the condensers are fixed and of high stability, tuning being effected by varying the inductance of the coils by means of an iron core, is highly desirable from the point of view of stability and simplicity of construc- tion.

It is comparatively easy to reduce the Q, or efficiency, of this type of coil, when desired, either by winding the coils with solid wire or by adding a fixed resistance of known value in series or shunt with the tuned circuit.

Finally, it is essential that once a coil has been designed and constructed it retains its original electrical values and efficiency.

Absorption of moisture from the at- mosphere is one of the biggest factors influencing this condition, and for this reason all coils should be impregnated, or treated in some manner, to prevent the absorption of moisture.

In the case of short wave coils this is best achieved by treating them with a varnish made from trolitul in a suitable solvent.

Multi-layer coils, and those wound with litz wire, are best treated by first thoroughly de-hydrating them in a desiccator and then coating by flash dipping in a wax of low melting point, which, while not penetrating the wind- ings, effectively seals them from the surrounding atmosphere.

IMPROVED STABILITY OF 6U7-G

Stability in an I.F. amplifier is of paramount importance, as will be ap- preciated by all radio engineers. One of the factors tending to result in in- stability is the value of the capacitance from control grid to plate of the I.F. amplifier valve.

Some considerable time ago, the pub- lished grid-plate capacitance for the 6U7-G was reduced from 0.010 to 0.007 uuF maximum. It should be under- stood that this maximum rating does not give any indication of the value for an average valve, but only a maxi- mum which the valves are guaranteed not to exceed.

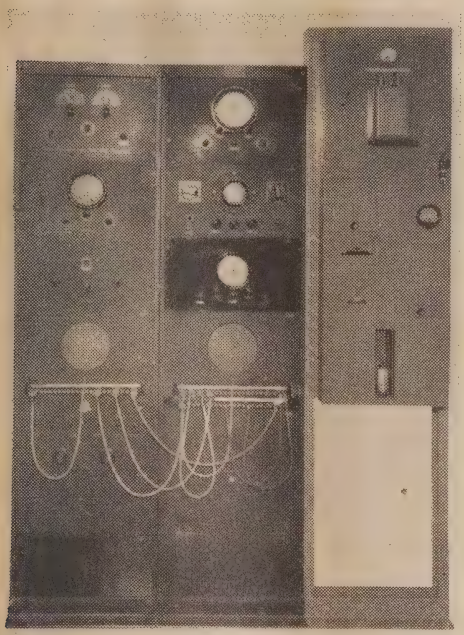
Occasionally, comparison is made be- tween type 6U7-G, with a published maximum value of 0.007 uuF, and other types, such as the 6K7, with a published maximum of 0.005 uuF.

Such a comparison is inclined to be misleading, since, although no change has been made in the published maxi- mum value, the average grid-plate capacitance of the 6U7-G is well below 0.005 uuF, and is practically identical to that of type 6K7. This improve- ment has been brought about by a modification of design, and this change has been in effect on our production for several months past.

In a high gain I.F. amplifier incorporat- ing type 6U7-G, it is desirable to em- ploy either a correctly shaped shield to fit closely to the dome of the valve at the level of the internal shield, or a form-fitting shield, in order to make full use of the low inter-electrode capa- citance of the valve. Care should also be taken with the wiring and lay- out, and the shield-cans of the I.F. transformers should not be relied upon for complete screening. With atten- tion to detail of this kind, high gain I.F. amplifiers using the 6U7-G may be designed to have excellent stability.

—Radiotronics.

MEASURING B'CAST STATION FREQUENCIE



The set-up for frequency measurements at A.W.A. With this apparatus broadcast station frequencies may be measured accurately to within one part in one million.

One of the best known methods of measuring frequency is by the tuning fork. As a rule, a fork vibrating at the fundamental standard of frequency, 1000 cycles, is employed.

THE frequency of this standard is too low to be of value in the direct measurement of broadcasting station frequencies, so recourse is made to a second, or substandard, source of frequency controlled by a 100kc's crystal oscillator.

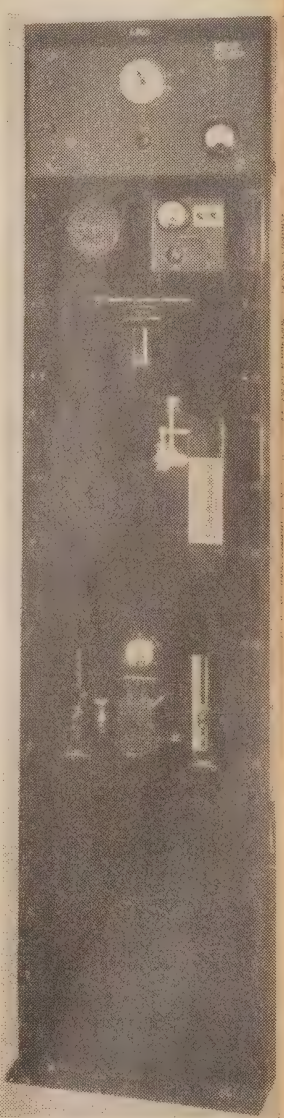
The heart of this unit is a 10kc's relaxation oscillator of the thyratron type which is controlled, as previously mentioned, by the 100kc's crystal. The output of this oscillator is extremely rich in harmonics, that is, in addition to the fundamental frequency of 10kc's there are frequencies, of 2, 3, 4 up to 2000 times this fundamental.

The 10kc's fundamental tone of this relaxation oscillator is compared directly with the 1000 cycle fork, and so is accurately measured (to one part in a million). Consequently, the frequency of each of its harmonics is also known to the same degree of accuracy.

When the A.W.A. research staff measures the frequency of a broadcasting station, the output from this secondary standard oscillator is applied, along with the signal, to the aerial terminal of a receiving set. In the process of detection, tones are produced of frequencies equal to the difference between the signal frequency and those of the adjacent harmonics from the oscillator. Normally only two of these tones are produced—the set is sufficiently selective to discriminate against any others. Generally, one of these is much lower in frequency than the other, and by varying the tuning position and the selectivity of the receiver, this one alone can be produced. This tone, known as a beat or heterodyne tone, is compared with the tone from an accurate audio oscillator.

Suppose, then, that a signal of approximately 720kc's was to be measured. The receiver would be tuned to this signal and the harmonic generator signal applied. If the signal were high in frequency, beats would be produced with the 720 and 730kc's harmonics. If low, the 710 and 720kc's harmonics would be the beating frequencies. Suppose that the deviation was of the order of 200 cycles high. Then the beat with the 720kc's harmonic would be approximately 200c's—that with the 730kc's harmonic would be 9800c's. By increasing the selectivity of the receiver, this last may be eliminated leaving only the 200c's note in the receiver output. This output is fed to one pair of plates of a cathode ray oscillograph—the other pair is fed from an accurately calibrated audio oscillator, the frequency of which is adjusted until an elliptical figure appears on the screen. The beat note and the audio oscillator are then at the same frequency, hence the beat frequency may be determined.

To determine whether the signal higher or lower in frequency than t harmonic generator, the frequency the latter is caused to fall by a f parts in a million. If the frequency the beat note rises (as it would in t case considered), the signal frequen is high, if it falls the signal frequen is low, and the beat frequency is add to or subtracted from the appropria harmonic frequency accordingly, th giving the correct signal frequency wi an accuracy of one part in a million.



The 1000 cycle fork driving the synchronous clock.

YOU CAN BUILD AN ELECTRIC GUITAR

Here is a back view of the cabinet with the amplifier in position. The bottom edge of the speaker may be seen behind the amplifier itself. At the rear of the chassis are the controls, input jack, and power plug. The valve at the extreme right is the Barretter.

Here is the outfit complete. The amplifier and speaker case is at the rear. Also shown are the guitar itself, and the case which houses it.

Here is an article describing the apparatus required for the "Electric Guitar," which is becoming so popular for use in dance bands, as well as for private purposes. It will serve as the answer to many questions we are asked from time to time.

☆

FROM a number of special receivers and amplifiers which have been recently developed in the laboratories of Radio Equipment Pty., Ltd., one of unusual interest, has been chosen for description. This is an amplifier especially designed for operation in conjunction with an electric steel guitar.

Before describing the amplifier itself, we will first explain the operation of the electric guitar, and examine the necessary requirements of a suitable amplifier.

In the ordinary steel guitar six steel strings are used. These are fastened at one end to a thin sounding-board, which forms the front panel of the instrument. As the strings are plucked they vibrate, and the vibrations from the strings, in turn, cause the sounding-board to vibrate.

NEW PRINCIPLE

The movements of the large surface area of the sounding-board set up sound waves in the surrounding air. Some people have the idea that it is the vibrating strings themselves which produce the sound waves, but this is not so, for the surface area of the strings is too small to produce a loud volume of sound. The surface area of the sounding-board is many times larger than that of the strings, so that the vibrations of this large surface can disturb sufficient air to represent a reasonable volume of sound.

In the electric guitar the framework is solid, instead of being hollow, so that there is no thin sounding-board which can vibrate. As the steel strings are plucked they vibrate, but, as previously mentioned, produce very little sound. The frame is not completely solid, but has a cavity into which fits a strong permanent magnet, together with a coil of thousands of turns of thin copper wire. Passing up through this coil to a position immediately below each string are six iron teeth. Over the strings is another piece of iron, so that the magnetic lines of force from the magnet are concentrated in the space in which the strings vibrate. As each string vibrates it varies the number of magnetic lines of force through the coil, at the rate at which the string is vibrating, and in proportion to the strength of the strings' vibrations.

Whenever there is a change in the

strength of magnetic lines of force through a coil, there will be a voltage induced in the coil, and in a guitar, the frequency of the voltage generated will equal that of the string vibrations, while the strength of the voltage will be determined by the strength with which the strings are plucked. If several strings are vibrating at the one time, there will be a number of voltages generated in the coil, and the combination of these will represent the sounds of the guitar at any instant.

AMPLIFIER AND SPEAKER

To make use of these voltages, it is necessary to amplify them and feed them to a loud speaker so that they can be heard. By using a suitable amplifier and speaker, the reproduced sounds can be made many times louder than those from an ordinary guitar, while the volume can be changed at will by means of a volume control, which is usually mounted on the face of the guitar itself. A tone control is frequently provided also, so that the tone quality can be changed. This makes the instrument very versatile.

The voltage induced in the coil of most steel guitars is very much weaker than that delivered by the detector valve of a radio set, or by ordinary gramaphone pick-up. This means that an amplifier suitable for guitar use must have more gain than one for use with a pick-up or radio tuner.

A.C.-D.C. OPERATION

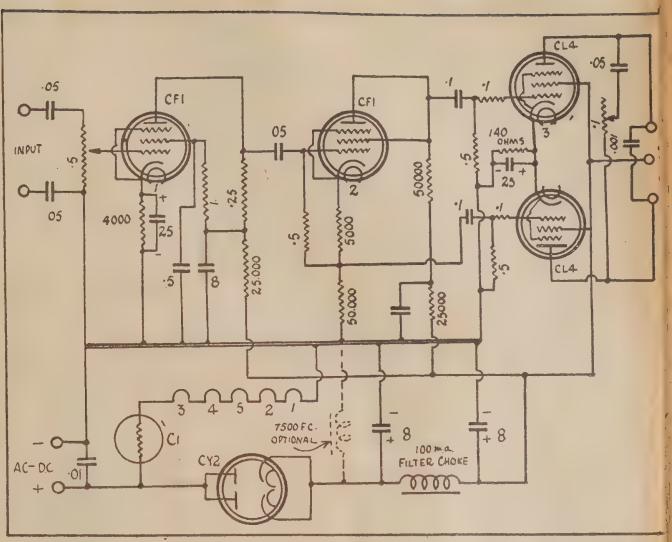
In the centre of most of the capitol cities and in many large country towns, the power supply is direct current while suburban areas and other country districts the power is alternating current. To enable the guitar to be used equally well in any area where power is available, it is necessary that the amplifier be designed to operate either from A.C. or D.C. mains.

The circuit diagram which was finally decided upon is shown in the accompanying illustration. Three amplifying stages are employed. The first tube is a high gain pentode. The second is a pentode tube connected as a triode, and used as a phase inverter for supplying the grids of the two output tubes, which operate in push pull.

SERIES FILAMENTS

As it is impossible to use a power transformer, for supplying heater voltage for the tubes, when operating on D.C. mains, the tube heaters are all connected in series, and the mains voltage, is reduced to a suitable value by the barretter "C1." The CY2 rectifier provides D.C. output when working on A.C. power mains and safeguards the electrolytic condensers from harm, when operating on D.C. mains, if the power plug should be inserted the wrong way round in the power point.

As one side of the power mains is directly connected to the metal chassis, anyone touching the chassis and a water pipe or any earthed object at the same time, may receive a severe shock. To guard against this, the whole amplifier should be enclosed in a wooden cabinet. On no account should an earth wire be connected to the chassis. The guitar itself is isolated from any dangerous voltage by the .05 mfd. condensers connecting to the input terminals.



To reduce the possibility of hum pick-up, the tube heaters must be wired in the order shown in the diagram. The wire connecting the grid of the first tube to the moving arm of the volume control and the lead from the volume control to the .05 mfd. condenser, should be carried out with shielded wire, the shielding being soldered to the chassis. In laying out the chassis, it is essential to place the C1 and CY2 well away from the first tube, otherwise hum will be picked up by this tube.

8 WATTS OUTPUT

As the power output of the CL4 tubes is approximately 8 watts, it is important to use either a 10in. or 12in. speaker to handle this power. The speaker impedance should be 12,000 ohms plate to plate. Either a permanent magnet or electro-dynamic speaker can be used. If an electro-dynamic type is employed, its field coil should be connected as shown by the broken lines in the circuit diagram, and it should have a resistance 7500 ohms.

The full output of 8 watts is ample f use even in large halls, or it may be r duced to a whisper for quiet practice the home by means of the volume co trol.

Another type of electric guitar co sists of an ordinary steel guitar, with small contact microphone attached the sounding-board. The output volta of this type of microphone is mu weaker than that of the guitar describ in this article, so that an additior amplifying stage may have to be add to the amplifier if it is to be used in co junction with a contact microphone. T amplifier, as it stands, however, will pr vide ample gain for guitars containi the magnet and pick-up coil.

The gain of the amplifier is somewh more than is actually necessary f gramophone pick-up work, but this is n a disadvantage, and the amplifier w give excellent results when operated wi a good quality pick-up.

The amplifier removed from the cabinet.

R.C.S. COILS give you the World's *BEST RESULTS!*

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00 ohms. bias resistor. Cat. No. R28.		9
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NEW 4/5 DUAL WAVE unit type DW29, comprising aerial and oscillator coil mounted on wave change switch complete with padder.
D.W. Unit Cat. No. DW29. Retail Price, £1/5/-.

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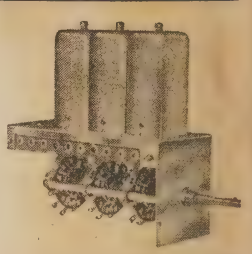
20 "	"	25 Amp.	"	PT39	4/6
30 "	"	.25 Amp.	"	PT34	4/6
400 "	Potentiometer	50 M/A	"	PT46	4/6
1000 "	"	35 M/A	"	PT47	4/6
2500 "	"	30 M/A	"	PT49	4/6
5000 "	"	30 M/A	"	PT51	4/6
10000 "	"	29 M/A	"	PT52	4/6
15000 "	"	20 M/A	"	PT53	5/9
20000 "	"	15 M/A	"	PT54	6/-

DUAL WAVE COILS

B/C 1500 to 550 K.C. S.W. 16 to 50 Metres.
Air Core Aerial Coil, 460 K.C. Cat. No. G19. Retail Price, 12/6.
Air Core R.F. Coil, 460 K.C. Cat. No. G20. Retail Price, 12/6.
Air Core Oscillator Coil, 460 K.C. Cat. No. G21. Retail Price, 12/6.

R.C.S. TROLITUL BROADCAST COILS

Air Core Aerial Coils, 460 K.C. Cat. No. E282. Retail Price, 5/9 ea.
Air Core R.F. Coils, 460 K.C. Cat. No. E283. Retail Price, 5/9 ea.
Air Core Oscillator Coils. 460 K.C. Cat. No. E284. Retail Price, 5/9 ea.
Permeability Tuned Aerial Coil, 460 K.C. Cat. No. E279. Retail Price, 7/6 ea.
Permeability Tuned R.F. Coil, 460 K.C. Cat. No. E280. Retail Price, 7/6 ea.
Permeability Tuned Oscillator Coil, 460 K.C. Cat. No. E281. Retail Price, 7/6 ea.



DUAL WAVE UNIT

B/C 1500 to 550 K.C. S/W 16 to 50 Metres. Aerial, R.F., and Oscillator, 460 K.C., A.C., Cat. No. DW24. Retail Price. £3/3/-.
Aerial, R.F., and Oscillator, 460 K.C. Battery. Cat. No. DW25. Retail Price, £3/3/-.

TROLITUL INTERMEDIATE TRANSFORMERS

The new R.C.S. Trolitul I.F.'s are extremely stable, due to new method of construction, made possible by the use of Trolitul formers and base. No loose wires to shift and alter frequency. Positively the best I.F.'s yet produced.

Air Core, 1st, 460 K.C., sq. can, 3in. x 1 3-8in. Cat. No. IF107. Retail Price, 7/6.
Air Core, 2nd, 460 K.C., sq. can. 3in. x 1 3-8in. Cat. No. IF108. Retail Price, 7/6.
Iron Core, 1st, 460 K.C., sq. can, 3in. x 1 3-8in. Cat. No. IF109. Retail Price, 10/6.
Iron Core, 2nd, 460 K.C., sq. can, 3in. x 1 3-8in. Cat. No. IF110. Retail Price, 10/6.

Perm. Tuned, 1st, 460 K.C., square can, 3¾in. x 1 3-8in. Cat. No. IF113. Retail Price, 12/6.

Perm. Tuned, 2nd, 469 K.C., square can, 3¾in. x 1 3-8in. Cat. No. IF114. Retail Price, 12/6.

STARS AND M.C. MIDGETS

Max. Cap. mmfd.	Min. Cap. mmfd.	Cap. Plates.	STAR Cat. No.	Price	MC Cat. No.	Retail Price
10	3	2	CV34	3/-	CV41	6/-
15	3	3	CV35	3/3	CV42	6/6
25	3.5	4	3V36	3/6	CV43	7/-
35	4	5	CV37	3/9	CV44	7/6
50	4	7	CV38	4/3	CV45	8/-
70	5	9	CV39	4/9	CV48	8/6
100	6	14	CV40	5/3	CV47	9/-

TROLITUL MIDGET CONDENSERS

R.C.S. Midget Condensers are made in two types, using Trolitul supports, thus guaranteeing practically no loss. The 14-plate equals old style 23-plate capacity. The M.C. type may be ganged.

Obtainable from your local dealer, or write direct to:

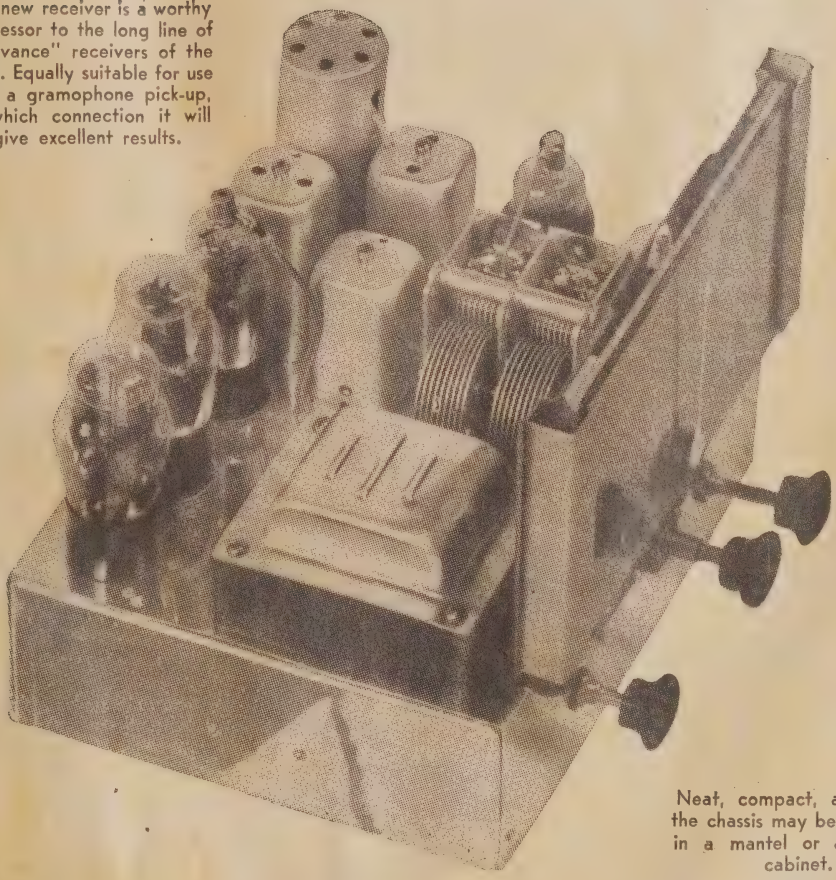
R.C.S. RADIO

50 Glebe St., Glebe PTY., LTD. 'Phone: MW2405

THE BEST AND SIMPLEST B/CAST SET

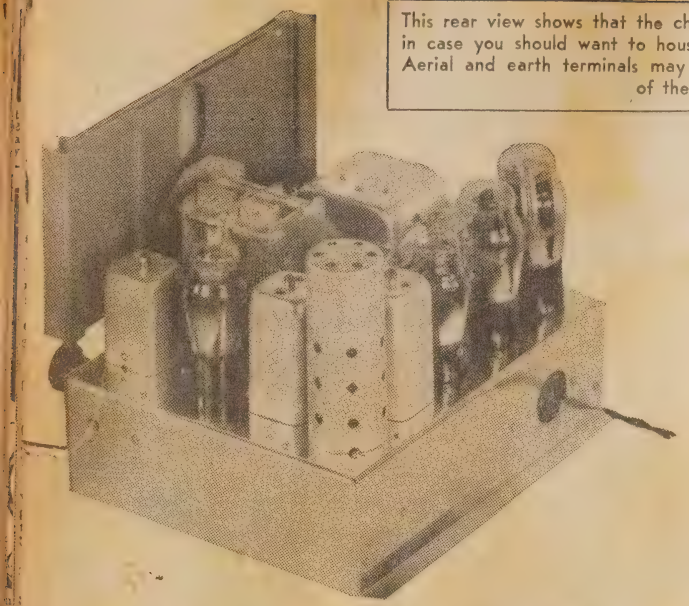
"ADVANCE 1939"

This new receiver is a worthy successor to the long line of "Advance" receivers of the past. Equally suitable for use with a gramophone pick-up, in which connection it will give excellent results.



Neat, compact, and small, the chassis may be mounted in a mantel or a console cabinet.

FULL CONSTRUCTIONAL DETAILS TO FOLLOW



This rear view shows that the chassis has been kept small, in case you should want to house it in a mantel cabinet. Aerial and earth terminals may be mounted at the back of the chassis.

A SET SPECIALLY BUILT

"Just a good, simple set." That sums up the "Advance '39." It has been designed to serve as a standard whenever such a circuit is required. It costs very little to build, and should be just the thing for the man who finds

By JOHN MOYLE

IT is some little time now, since we described a simple, easy-to-make receiver for the broadcast band, which fills the requirements of the man who wants something to give him good results, and which won't be too expensive to build.

Almost every year since about 1932, we have worked out designs for a set of this nature, taking advantage of new valves, and new ideas, as they came to hand, and published them under the name "Advance."

These sets were not intended to do startling things, or to provide unbelievable results from a small number of valves.

They were just straightforward, downright good sets, which anyone could build up without straining his bank-balance, and which were guaranteed, if it is possible to do such a thing, to give good results with a minimum of effort.

It came to our notice recently, that such a receiver was overdue. So far as "Radio and Hobbies," we have covered a good deal of ground in radio, as a glance at our past designs will show.

But, so far, we haven't described a set of the type we have outlined above. It's time we did.

So we began to look through the circuits of the day, to see what we could arrive at which would conform to all these requirements.

Strangely enough, while we were thus cogitating, there arrived in the post, a copy of "Radiotronics," that excellent little publication sponsored by the A.W. Valve Co. And there, staring us in the face, was a circuit which seemed to have all the things we wanted.

DESIGNING THE SET

Actually, when one sets out to "design" a set of this type, there is always the simplest way to do everything. In using the circuit mentioned, or almost exactly the same circuit, we didn't feel we were letting ourselves down, or anything of that kind.

For, as we have said, if several people set out to supply a circuit with certain things in mind, most of them will arrive at almost the same result. The circuit was so like the type of thing we have been used to building, as to be almost identical with our own ideas.

In addition, there are one or two modifications, which we would not have cared to make ourselves, without approval from the engineers who design and build the valves.

For it is hardly a fair thing to wire valves into hook-ups which, although unconventional, are for that very reason, frowned on by the makers. We have done this occasionally, and, so far, have been quite successful.

But take, for instance, the omission of the grid condenser in the oscillator section of the 6A8G. We know that valves will work quite well that way, but it's nice to know the idea is recommended by the valve makers before ourselves recommending it to our readers.

We must always remember that many home-builders very properly keep strictly to the various circuits we present from time to time, and, in a sense, hold us responsible for giving them sound ideas, and not doing crazy things which are often easy, but rarely pay for wholesale distribution.

So, with these introductory remarks, we present the "Advance 1939" in the knowledge that it will work! And if there are a few things in it which you feel inclined to scratch your chin over, do the scratching, and then try it out. You'll find this set will do all we say it will.

THE CIRCUIT

Now for something about the circuit!

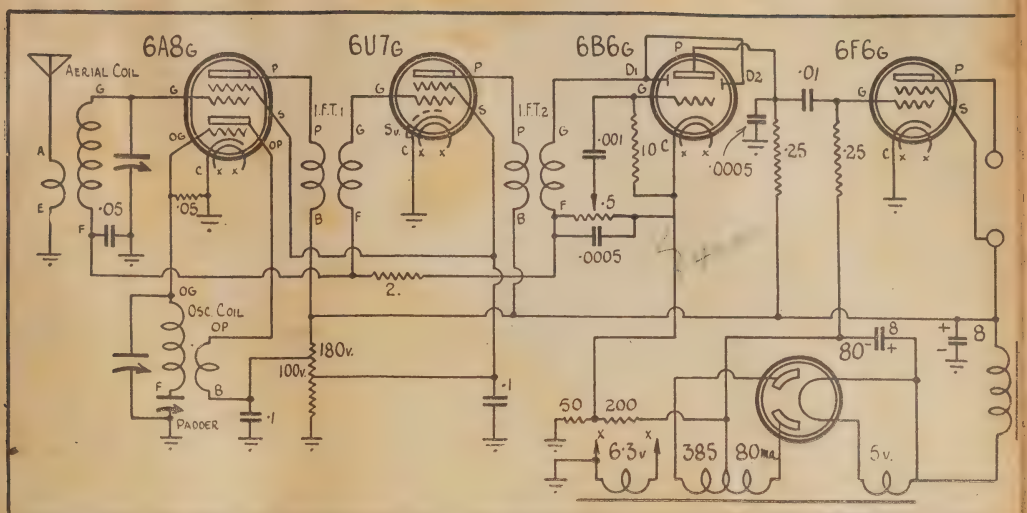
You will see, first of all, that the valve designation specifies the latest types of octal-based glass valves. If you are making the set from scratch, keep to these valves, as you may as well have the latest, even though other and older types will work just as well, being in fact, the same thing with different bases, and, possibly, different filament voltages. Later on we will tell you what valves you can use in place of those mentioned, should you already have them on hand.

In fact, just to prove the point, we built the original with mixed valves, so we know they will work that way.

THE CONVERTER

The converter valve shown is a 6A8G. This has been used because in most ways it is the best converter valve for the money.

Some may wonder why the newer 6K8G is not used here. Well, first of all, the 6A8G is a slightly better valve to use on the broadcast band, although



Here is the circuit. It is sometimes desirable to wire a .1 mfds condenser from high tension to earth. This condenser is included in the wiring diagram, and is optional. Optional also is a .005 condenser across the speaker.

FOR BROADCAST RECEPTIO

he must have a set, in these difficult times, but whose purse is limited. But it's more than "just a set!" You'll find it a reliable and sound performer as well. Suitable connections for pick-up are given.

it is not as good as the 6K8G on short waves. Our set not being a dual-waver, to keep the cost down we don't have to worry about this point.

Now for equivalents. These are the 6A8 and 6A7, in the 6-volt series, and the 2A7 in the 2.5-volt series. Theoretically, there is a slight difference in the coils for these valves, but frankly we haven't found it amounts to a packet of pins in practice, unless you want to chase the maximum figures obtainable in the laboratory. You won't miss anything if you have a 6A7 oscillator coil, and use it with a 6A8G. So stop scratching your chin!

NO GRID CONDENSER

It doesn't save much to omit the grid condenser, but it is an extra shilling or so, so we may as well accept the valve makers' statement that it is O.K. and leave it out. Please note that this applies only to the broadcast band, and not to the short-wave bands. That's another family altogether.

You will find the set to perk perfectly well with the coil connected straight to the oscillator grid. But don't carry it too far, and decide to do without the grid leak also. That's not permissible —at any rate, not yet!

Apart from this point, the converter

LIST OF PARTS REQUIRED

Chassis, 10 x 8 x 3 inches.
1 Tuning dial, broadcast only.
1 465kc Superhet. coil kit for broadcast band.
1 2-gang condenser with trimmers.
1 Power transformer 385-0-385 at 80 meg., 5v and 6-3v windings.
2 8 mfds electrolytic condensers.
1 25 mfds electrolytic.
1 .5 meg potentiometer.
2 .1 mfds tubular condensers.
1 .25 mfds tubular condenser.
1 .01 mfds tubular condenser.
1 .001 mfds mica condenser.
2 .0005 mfds mica condenser.
1 10 meg resistor.
1 2 meg resistor.
2 .25 meg resistors.
1 .05 meg resistor.
} ½ watt.
1 200 ohms bias resistor.
1 50 ohms bias resistor.
1 25,000 ohms voltage divider.
Valves—6A8. 6U7G, 6B6G, 6F6G, 80.
Speaker—2000 ohms, P.C., matched for 6F6G.
Sockets—4 octal, 2 4-pin, hook-up wire, &c.

circuit is exactly the same as those have been used to. Just make a r that the cathode is earthed, beca there is a natty little back-bias round the corner, which is also someth like a hook-up used in an Advance former days.

The voltages for this valve are tained from a standard 25,000 ohms v age divider. A .1 condenser bypasses oscillator plate voltage tap to earth.

In short-wave sets, it is a good p to use an 8 mfds. condenser here in ad tion to help stabilise the supply. the broadcast band, however, this i important unless your set is a very, v hot one, and starts "fluttering" when after weak stations. We don't think will do this, particularly as you wo not use this circuit if you were bui a real "ether-searcher." You'd co sider a 5-valver an insult, no doubt. I read on.

THE I.F. AMPLIFIER

A 6U7G is specified as the I.F. amp fier. Equivalents here would be 6K7G, 6K7, and 6D6 in the 6-volt ser and the 58 in the 2.5-volt types.

There is nothing much to comm upon in this part of the set. T cathode you will notice is again earth and this valve, as with the convert is connected to the A.V.C. circuit.

A.V.C. HOOK-UP

The A.V.C. is exactly the same as we have used on small sets for years. Once it was considered very bad practice to wire both converter and I.F. valves together through a common decoupling network, and hook the lot to the "hot" end of the volume control.

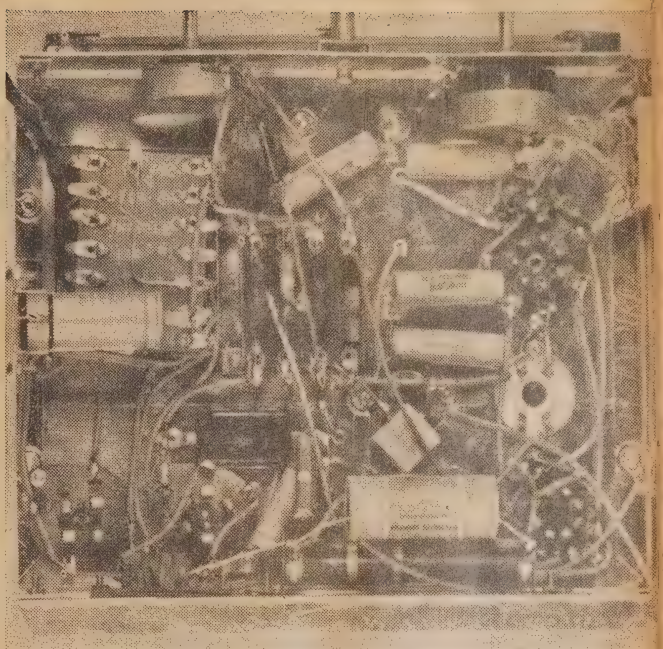
However, we have done just this for so long that we can only approve the use of such a circuit in this receiver. Being fair-minded, we will admit that in the final analysis it would be better to decouple separately, but as simplicity is our aim, we assure you it's quite in order.

A.V.C. in a set of this nature is used mainly as a handy leveller of signal strength, to prevent annoying work with a manual control if it were not there. It is not intended to give that never-reached ideal A.V.C. control which isn't required in an every-day receiver.

Therefore, a single .05 mfds. condenser, and a 2 meg resistor are all we use in the A.V.C. line. The A.W.V. circuit uses 1.75 megs here because it is allegedly cheaper. However, many home-builders may find this odd value hard to obtain, and the extra cost to him will only be a matter of pence. No doubt the designers of the original circuit had factory production in mind, where pence are pence!

SECOND DETECTOR

The second detector is shown as a 6B6G. Equivalents are the 6Q7, and 75 in the 6 volt series, and 2A6 in the 2.5 types.



A very good picture from under the chassis. Note the insulated resistor strip in t centre. Also the tubular .8 mfds electrolytics. Trolitul coils were used in this set.

You will immediately come to the conclusion that there is no bias on this valve because the grid leak returns to the cathode. And look at the v —10 megs! Some mistake here!

But no, sir, there is no mistake. A the valve makers have sponsored circuit as being satisfactory, and have found it so also. A certain amo of grid current will flow in a circui this kind, due to the "contact potent effect in the valve, and the bias developed, of the "grid leak" type enough for the slender requirement the valve used.

Incidently, this is added to by rectification of R.F. voltage picked from the diode-load-volume-control the slider moves up and down the sistance, but the makers point out this does not adversely affect the o ation of the valve. In this, we can concur.

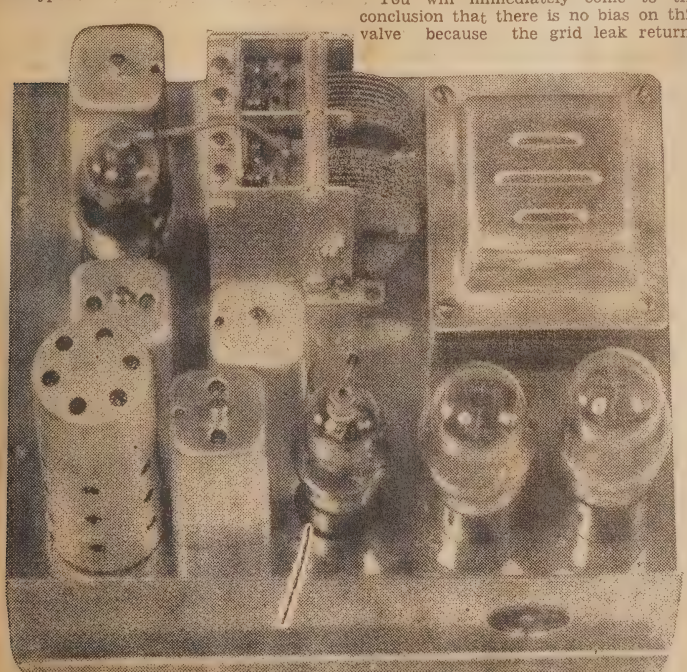
Note also, the absence of the u filter in the diode circuit of the va We have also been in the habit of le ing this out in former circuits, and passing any R.F. which might through by the condenser from p to ground. We don't think you will any trouble due to instability from cause.

Incidentally, the low value of coup condenser in the grid circuit is al able because of the high value of leak—10 megs.

THE BACK-BIAS

The cathode of the valve is not c nected direct to earth, but is tap to a portion of the back-bias resi which provides bias for the output va

This, it is stated, "together with effects of contact potential in the di and the bias developed by the n



A good idea of the layout is obtained from this picture. Can type electrolytics could be mounted in front of the power transformer.

voltage, provides an effective voltage of minus 3 volts between earth and the control grids with a very weak signal. Any loss of sensitivity due to the use of simple A.V.C. is thereby eliminated." Which is another way of saying what we have said in commenting on this system in connection with past receivers.

The "noise voltage" referred to, you will remember, is there because of the fact that when not receiving a signal, the noise level of the set is at its highest. This noise is in effect a small signal, and develops a voltage across the diode load. So that the voltage on the controlled grids never runs to zero, as might at first be assumed.

BIAS RESISTORS

The original circuit showed a tapped resistor of 250 ohms for back-bias. That may be all right for manufacturers, who can make any resistors they require, but there might be trouble in getting a tapped resistor from your radio dealer. So we have used two—one of 50 ohms, and one of 200 ohms, wired in series. Same thing only different. And resistors are not very expensive.

In our set, we found the use of a 25 mfds. electrolytic condenser wired across the back-bias resistors, desirable to reduce hum to a minimum. In the past, when using this circuit, we have made this condenser optional, and you can try it without if you wish.

But if you use a good speaker, on a decent baffle (as in a console cabinet), you will probably find the hum a bit high. We haven't included this condenser in the circuit, but we have included it in the wiring, to show you just where it goes. We suggest that you use it anyhow.

OUTPUT STAGE

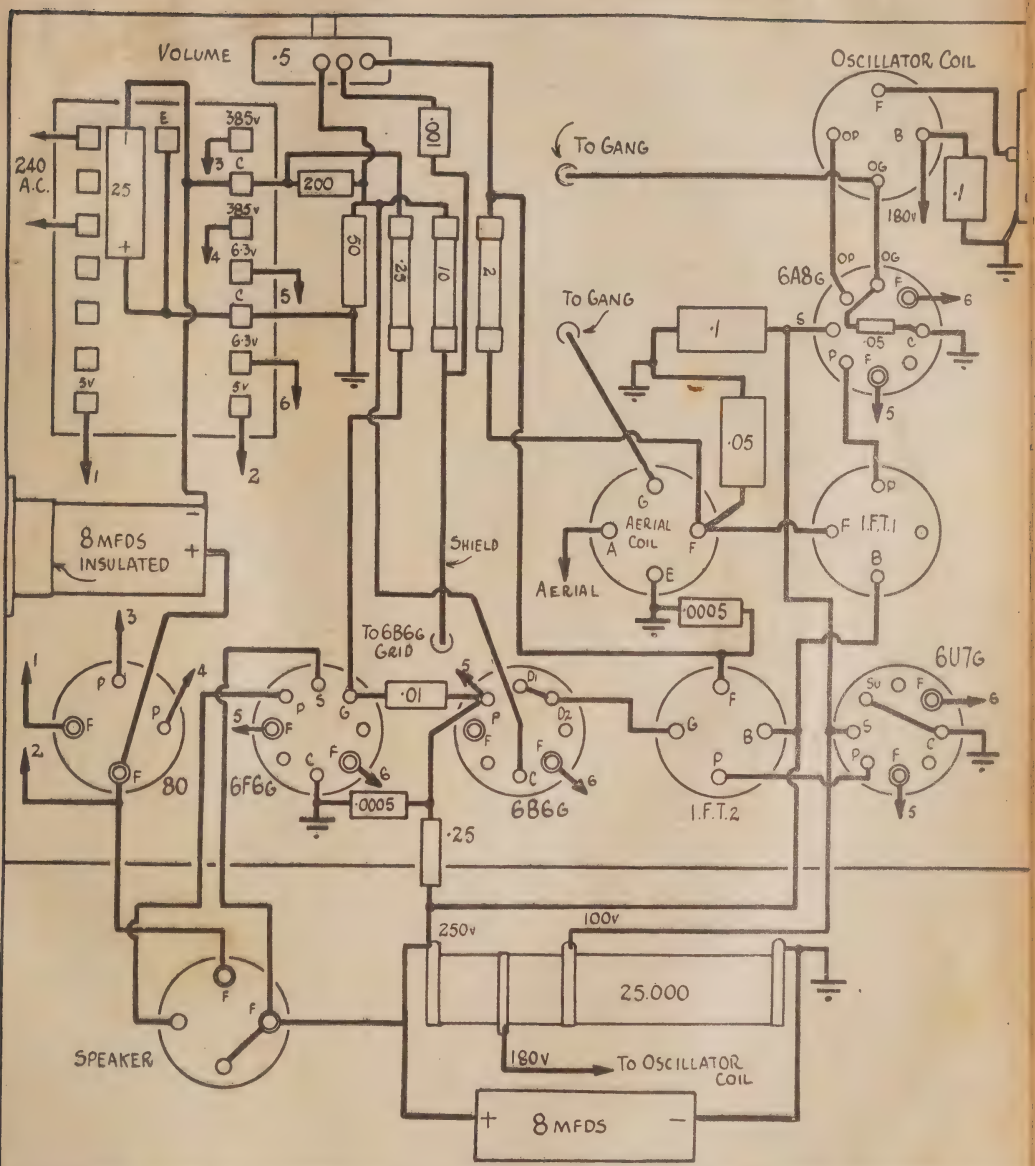
The output stage is quite conventional and there isn't much to say about it. The valve shown is a 6F6G. Equivalents are 6F6, and 42 in the 6-volt type, and 2A5 in the 2.5-volt valves. No change in any value for these.

It is quite a good idea to wire a .005 condenser from plate to screen of the output valve for several reasons. In the first place, it takes a little "edge" of the tone, and, secondly, it is a handy R.F. by-pass should there still be something left when you get to the speaker. We didn't find it necessary, particularly as we finally added a continuously variable tone control to the set, mainly to balance the front panel.

You can please yourself about this. In the extra circuit showing where and how to add this control, you will see it included, just to indicate where to put it.

SPEAKER

The speaker can be almost anything you like, according to how you house the set. You can use one of the 12in. types if you want best results, or if you mount the set in a mantel cabinet, a smaller speaker will do. The field is 2000 ohms. We have found the bigger speakers are more efficient as filter chokes, which is as it should be, for when a console cabinet is used, we want to get that residual hum down as low as possible. It isn't as important with



The wiring diagram shows how the parts are connected. Drawn to scale, you can work your layout from it.

a mantel, because the baffle area is so much smaller.

The rectifier we have shown is the 80. It is the same price as the 5Y3, the latter having an octal base. That's the only difference. Take your pick. A 5Z3 would also do if you have one, but get one of the others if you are buying all new material.

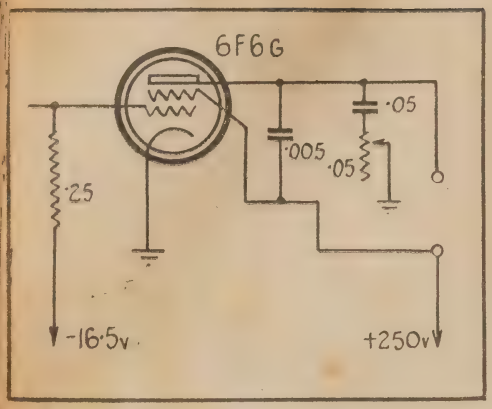
COMPONENTS

That covers the circuit pretty well. The other components can all be standard types. As there is no particular need to chase extremes of performance in a set of this nature, you can economise, and use the simple coils if you like, to buy the more expensive iron-cored types if you have a little more money. A trifle better selectivity and gain can be expected from the latter. We used the plain types, if we remember correctly, and had no trouble in tuning in anything we wanted.

This, of course, is one of our aims—to present a design which, literally, w work with anything.

The tuning condenser is of the ordi ary standard type, with trimmers, course, and you can use any kind dial you please, which matches in calibration.

All the resistors may be of the hal watt type, with the possible exceptic of the 10-megger. This, we doul whether you will obtain in the sm size. Naturally, the divider, and t



★

This circuit shows how to wire a continuously variable tone control to the set. Note also the .005 mfds condenser across the speaker. It's a good idea to include this condenser whether the tone control is used or not.

★

is resistors, are wire-wound. The lat- should be able to carry, say, 80 mills.

ONSTRUCTION

Building the set is very simple. Our ring diagram is drawn to scale, which ould be a help. Note that we used e new small tubular electrolytics ounted underneath the base. You can e the ordinary can type if you like they will fit in front of the power ansformer if you keep it well back on e chassis. Don't forget that one of them is insulated from the chassis. That's important.

Above the base, the converter valve has its cap connected across to the rear section of the gang. The front section tunes the oscillator coil. The I.F. amplifier grid cap connects to the lead from the top of the first intermediate. The cap of the second detector runs down with a shielded lead, under the chassis.

The padder mounts at the side of the chassis under the base. If you drill a hole for it, you can adjust from outside without having to turn the chassis on its back.

LINING-UP

Lining the set is exactly the same as with any other similar job. If you have the right dial, it will be a great help.

First unscrew the trimmers on the gang about half-way, and loosen the padder about three full turns.

Now turn the tuning dial till you have, shall we say, 2SM. It probably won't be in the right spot as indicated by the dial. If not, adjust the oscillator trimmer until it is. After that, adjust the aerial trimmer till you get the best volume.

Now swing up to the other end of the scale to, say 2FC. It probably is also out of place. Don't touch the trimmers now, but adjust the padder till you get the stations tuning in at the right spot on the dial. This will no doubt be the same spot at which you will receive it at best strength.

Now go back to the first station, or, better still, a weak one a little lower down, and check on the oscillator trimmer for line with the dial marking. Readjust the aerial trimmer a little for best volume. Your set will now be pretty well in line.

The intermediates may be touched up a little after all this is done with. Make a note of the exact position of the slot in the intermediate trimmers before touching them, so you can come back again if required. The only one

which will need more than a fraction of a turn will be the secondary of Intermediate No. 2, which tunes the diode circuit. You will probably need a bit more here.

PERFORMANCE

We found this set able to tune in almost anything on the air, and it showed a very useful degree of selectivity. For instance, 3LO and 2YA should be heard excellently at night, in Sydney, with an outside aerial. These stations aren't very hard to get, but we mention them as a possible check-up. Sixty stations at night would be an easy bag for this set.

There will be plenty of volume obtainable, and the tone will also be quite good, considering that no feedback is used.

USING A PICK-UP

We have given here the circuit for adding pick-up connections to the receiver. There is very little difficulty about such connections, and the set works very well indeed as a small gramophone amplifier.

One or two things should be borne in mind when using the set in this way, however. The volume one can obtain from a pick-up is quite high, and you will find the tendency is to turn it up much higher on records than with the radio.

One reason for this is probably that you will rarely play a record unless you mean to listen to it, but you will often play the radio while reading the paper, or while not actually listening to any particular item.

So don't be disappointed if the records don't appear to sound as loud as the radio. There is no reason why the set should not give exactly the same volume when used with the pick-up as it does for radio. If you take the trouble to make a check on this, you will find that it is so.

Secondly, if you use the pick-up, don't mount the set with a small speaker in a mantel cabinet. If you do, you can't expect to get the best results. If you don't want it to sound any better than a mantel radio, well and good.

But our strong recommendation is that should you have any idea of using the set for playing records, a good speaker, and a good heavy cabinet should be employed. We have nothing against the use of the small radio-combinations as such, provided the constructor knows what to expect. In fact we agree that they have introduced a very attractive note into the radio trade, and this receiver could well be used as the basis of such a combination.

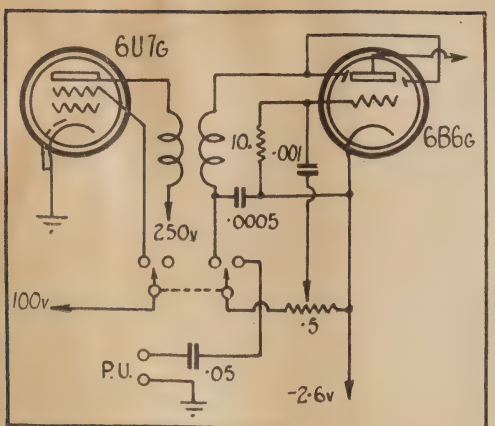
But again we say, for best results, see that your cabinet and speaker are such that they give you a chance.

THE PICK-UP

Almost any type of pick-up will be suitable for the receiver. Some sets are not suited to connection with crystal pick-ups, but the Advance will have no such difficulties.

The only precaution when using a crystal pick-up, and one which should always be taken with this type, is to

(Continued on Page 35)



If you want to use your Advance with a pick-up, here are the connections in advance! The R.F. section is thrown out of action — necessary to avoid having the programmes coming through at the same time as your record music.

wire a .1 mfds. blocking condenser between the "hot" end of the pick-up and the terminal of the set. It is not permissible to allow even a small voltage to be applied across the crystal, and this precaution will avoid the possibility of damage to it.

The .5 meg. volume control will operate on the pick-up equally well as for the radio, so there need be no doubt on this score.

Any of the magnetic types may also be connected direct to the receiver. Unfortunately, these pick-ups tend to wear the records rather more than the crystal type, but undoubtedly one can get a fairly good little magnetic pick-up much cheaper.

In any case, the use of non-metallic needles with the magnetic pick-up will greatly reduce wear, and even with the crystal it isn't a bad scheme to use these needles, with treasured records which might be played many times.

AN ELEMENTARY COURSE IN RADIO

(Continued from Page 17)

tive, care must be exercised in connecting these condensers in a receiver so that the foil connects to the positive side of the receiver's circuits, while the can, which makes connection with the liquid, connects to the negative side of the circuits.

Fig. 3 shows the construction of one of these condensers.

The dry or semi-dry electrolytic is not dry, but has the liquid soaked up in a porous paper, like thick blotting paper, or in a piece of cloth. Usually two sheets of aluminium foil are rolled up with sheets of the saturated paper or cloth between them, something like the rolled waxed paper condenser shown in Fig. 2. In this case one of the aluminium sheets acts as the positive condenser plate, while the moist cloth or paper acts as the other plate. The second sheet of aluminium is simply used for making connection to the paper or cloth. These condensers also have the layer of aluminium oxide formed on them during manufacture and this acts as the dielectric.

Due to the fact that the dielectric film is extremely thin and that it has such a high dielectric constant, it is possible to make a large capacity electrolytic condenser in a very small space. They are made in various sizes from 4 to 32mfds., and also in 500mfds. capacity.

The efficiency of eletrolytic condensers is not very good. They perform well in circuits operating at low frequencies, but they do not work at all well with high frequency currents, because their losses increase rapidly as the frequency gets higher. Their most common application is in filtering out hum from the power supply unit of mains operated sets, but they are also effective for use in circuits as audio frequencies. Their performance is so poor at radio frequencies that, in circuits where there are both radio frequency and low frequency currents flowing, it is generally necessary to shunt the electrolytic condenser by means of a paper or mica type condenser, connected in parallel with it, so that the low frequency currents can flow through the electrolytic condenser, while high frequency currents are handled by the more effecient paper or mica condenser. This is the reason that, in addition to the electrolytic condenser in the power supply, of a mains operated receiver, it generally is necessary to connect a .1 or .5mfd. paper condenser from B plus to the chassis to prevent oscillation.

Electrolytic condensers deteriorate with age and after they have been used for a couple of years, it is necessary to replace them if the receiver is to be kept in good condition.

4/39 SUCCES

Our hopes for the success of the 4/39 Dual-wave baby set recently described have not been disappointed. Hundreds of these sets must have been built since the issue was released, and city stores report it to be the latest "best-seller."

AT the present time, the 4/39 h a good deal to recommend it. small compact receiver, which co little if any more than £10 to bu and which will give excellent short-wa reception as well as the broadca stations, must expect to be popular.

During a recent attack of influen we kept the 4/39 close handy, and we thus able to make a close check on t stations received.

The short wave band continued to su prise us. Our tests with the set wh building, indicated, of course, that would perform well on short wave. B there is nothing like actually using receiver for hours on end, to becor thoroughly acquainted with what it c do.

PORTABILITY

It is very handy, too, to have a sm receiver which can be moved round t house with no trouble or fuss. In t past week, nearly every friend we kn has asked us at one time or anoth about a handy little set to get the En lish news service before turning in.

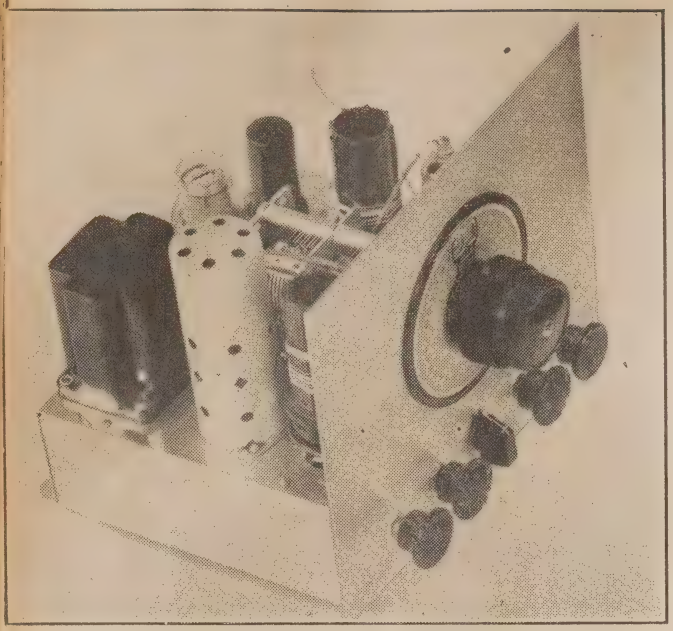
The 4/39 is ideal for this purpose course. In fact, if you were to screw carrying handle to the top of the cas you would have an excellent portable, long as you did not leave the A.C. ar of the country!

POWER TRANSFORMER

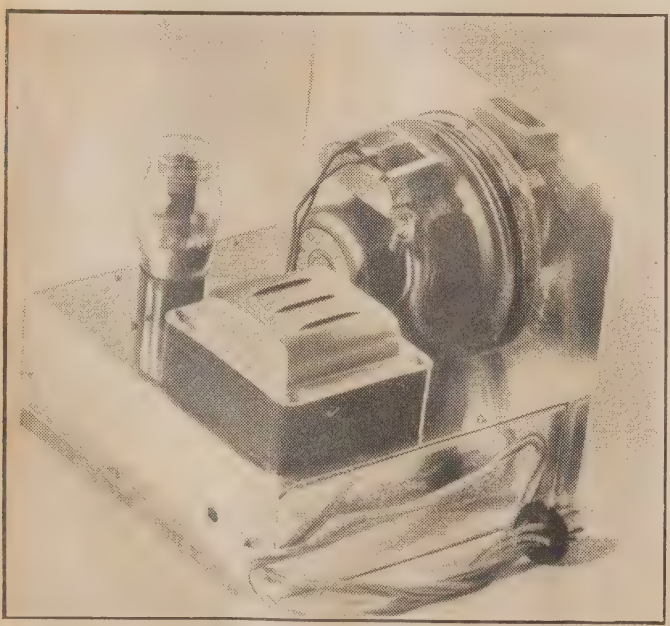
May we mention again that the actu secondary voltage of the power tran former for this set is 325 volts, and u 385 as we indicated. It was a revisio of rating on the maker's part, whic doesn't affect the set in any way, ar accounts for the circuit values of o receiver being what they are. So don puzzle your head about calculatio which don't seem to add up straight!

AS A BIG SET

Some have written asking whethe the 4/39 can be used with a larg speaker as a "big" set. This is quite logical idea, and the layout of the s may remain the same. A larger di may be used, and the loud speake mounted in a console cabinet in th usual manner. The fact that the set i a small one doesn't mean that it mus therefore be housed in a small cabine



A front view of the receiver which gives an excellent idea of its final neat appearance. The extra control may be a tone control, wired exactly as in the circuit given for the "Advance '39." The grid condenser and leak are under the cap of the valve shield in the foreground.



A rear view of the power-speaker unit. The chassis and panel are exactly the same size as those used for the receiver. The connecting cable is about 3ft. 6ins. long.

Building

☆

LAST month we described a simple four-valve T.R.F. short-wave set for battery operation—one which would provide the constructor with a starting point for experiment with all kinds of circuits of the T.R.F. variety.

We expected when presenting the set, that many would find it acceptable, and an answer to their requirements. So it has seemed from our letters—we know that already quite a few of these have been made, and more are on the way.

In mentioning the limitations of the T.R.F. circuit, we did not fail to point out that with them went many advantages from the experimenters' point of view.

We are very anxious that "Radio and Hobbies" should not become a magazine for the more advanced set-builder, to the neglect of many who are just beginning, or who hesitate to branch out into anything very complicated.

Building, as we do, so many different sets of all kinds, it is difficult at times to realise that, to many, things we regard as simple are not always this way to those who read about them. We don't think those of our readers who have lost interest in simple circuits will grudge us some space devoted to them. We all had to make a beginning, and from beginners to-day will come more advanced enthusiasts of to-morrow.

There are so many things one would like to feature in a paper of this kind that our trouble is to know where to stop. We have to remember that the most successful designs are primarily those which appeal to the largest number of readers.

The A.C. version of last month's short-waver we don't think requires any apologies. For we know in advance how many have been looking forward to it.

As there may be many who have not a copy of last month's issue before them, we may repeat here many of the things mentioned in that issue. But again we must endeavor to make each article stand on its own feet. Nothing is more annoying to see repeated references to another issue of the paper which may be missing when most required.

T.R.F. VERSUS SUPERHET.

So a word or two about the T.R.F. design as against the superhet. In the first place our sympathies are with the superhet. receiver because of its undoubted advantages of sensitivity and selectivity.

Perhaps we should qualify the matter of sensitivity, because it's not right to assume the T.R.F. set isn't sensitive.

A SHORT WAVE T.R.F. SET FOR A.C

Which Combines Power Supply with Speake

The receiver described here will bring in the overseas broadcast stations at full-speaker strength, and with careful tuning should receive practically anything you can hear on the superhet., although the volume may not be quite as great.

However, with careful attention to coils and lay-out, it is quite surprising what can be done with the T.R.F. set.

A good superhet. will generally do its stuff with less tinkering than will a T.R.F. receiver because, in the first place, there is not necessarily a reaction control to worry over.

Reaction on the T.R.F. receiver is all-important—much of the sensitivity is directly associated with it. You must strive to obtain reaction, which comes into action smoothly, and without any growl or "thrush-hold" howl.

This isn't very hard to do, if you are prepared in stubborn cases to spend a little time in adjustment. Once that way you will have many pleasant hours searching the ether for whatever may come your way.

GANGED TUNING

This receiver isn't quite the same as the old faithfuls of the past, however, because we have applied some of the modern lessons to it in several ways.

One of these is the use of ganged tuning. In the old days, we have separate dials for R.F. and detector stages, and it was quite a job to keep them in step. When jumping from one end of the band to the other much valuable time and patience was expended, and we well remember the nuisance of screwing away at two vernier dials, generally very slow motion, to get our stations lined up.

The use of a two-gang condenser, therefore, in conjunction with a very small aerial trimmer to compensate for small differences, allows us to jump from one wavelength to another some distance away without all this bother. It is surprising how accurately the circuits will keep in track once everything is finally adjusted.

As promised in last week's issue, we give these details of an A.C. short-wave set modelled on the battery receiver already described. It is rather appropriate that it should come at a time when news from the other side of the world is eagerly awaited by all. All the Empire station transmissions on 16, 19, 25 and 31 metres may be received at excellent strength whenever audible here. The circuit is so simple that many parts may already be in your junk box. It is very easy to make and requires no critical adjustments or lining up when completed.

The smaller trimmer is mainly useful to compensate for changes in detector tuning with varying reaction. Although we found the reaction fairly constant over the full tuning range, this is bugbear number one very largely eliminated.

Again, the present disposition of the short wave bands makes it possible, when using a gang of about 120 mmfds. (.00012), to cover from 16 metres to well over 35 metres without changing a coil. This is almost the same as with a modern dual-wave receiver. A coil to cover 16 metres is still reasonably efficient at 31 metres, particularly as, when this latter band is "wide open," signals come in with no little sock! Hence, constant coil changing is eliminated.

Thirdly, we have combined the lou speaker and power supply on a sin chassis, the same size as that used the receiver.

POWER-SPEAKER UNIT

The reasons for doing this are se eral. In the first place, it is most a visable, particularly where an au choke is concerned, to keep the pow supply well away from the receiver.

Failure to do this often results in hum being present in the speaker, d to inter-action between the pow transformer and the choke. This is very real difficulty, as it can still noticed, even with the set two or mo feet away from the supply, if the cho is not well shielded.

Secondly, it is a good idea to keep t speaker some distance away, to preve acoustic feedback. With a regenerati detector, this is more necessary th ever.

Now, with three units—speaker, pow supply, and set—we look like havi rather an awkward setup. Howeve there is everything to be gained combining these two units as we ha done.

In some cases, it might be desirab to use batteries with the set, in co junction with low-filament drain A type valves. In the country, for i stance, where 6 volts is easily obtaine a set using A.C. type valves is preferab to one using the 2 volt types.

By designing the set as we have don all the output leads come to a sing socket. To this socket we require feed 6 volts or so for the filaments, an up to 250 volts for the B supply.

This chassis can either be plugged i to our A.C. power unit and speake or connected to a battery box work on the same principle, without maki any changes to the set itself.

SPEAKER CHOKE

There is still another good word to said for the idea. The speaker field the A.C. version is used as a filter cho

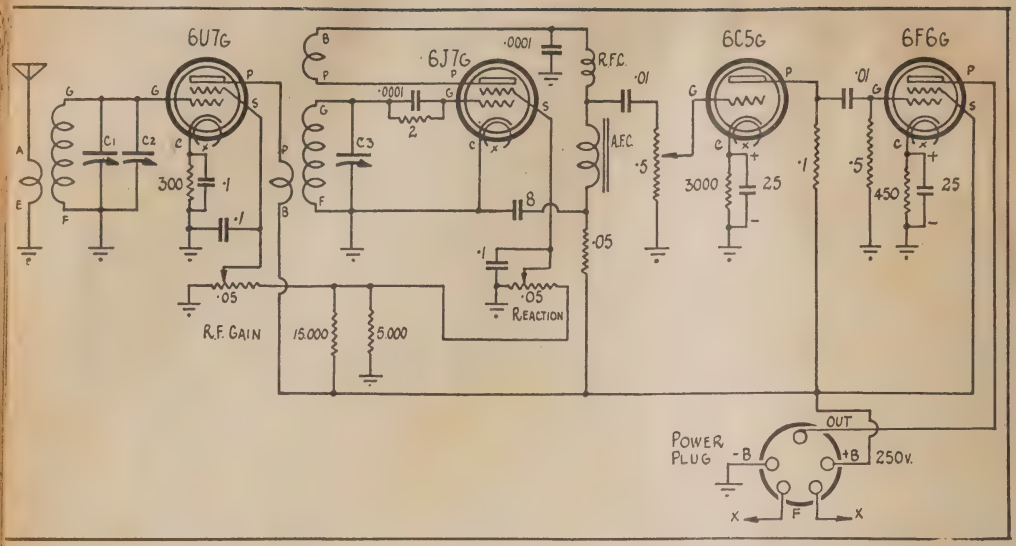
PARTS LIST

RECEIVER

1 Chassis, 8½ x 7 x 2½ inches.
1 Panel, 8 x 9½.
1 2-gang condenser, 125 m.mfds per section, or 2 100 m.mfds midgets—See text.
1 25 m.mfds midget condenser.
1 Vernier tuning dial.
1 Audio high impedance choke.
1 2 meg resistor.
1 .5 meg resistor.
1 .1 meg resistor.
1 .05 meg resistor.
1 3000 ohms resistor.
1 300 ohms bias resistor.
1 450 ohms bias resistor.
1 15,000 ohms resistor.
1 5000 ohms resistor.
5 watt types—can be voltage divider.
2 50,000 ohms potentiometer.
1 .5 meg potentiometer.
3 .1 mfds tubular condensers.
2 .01 mfds condensers.
2 25 mfds electrolytics.
1 R.F. choke.
Sockets—4 octal, 1 5-pin, 2 6-pin.
Valves—1 6U7G, 1 6J7G, 1 6C5G, 1 6F6
Six pin coil formers, &c.

POWER UNIT

1 Chassis 8½ x 7 x 2½.
1 Panel 8 x 9½.
1 Power transformer, 385-0-385v at m.a., 5v and 6-3v windings.
2 8 mfds electrolytics.
Speaker—4 or 6 inch type matched pentode, 2000 ohms field resistanc
Sockets—1 4-pin, 1 5-pin.
Valve—1 80 rectifier.
Five-way connecting cable and plu
Hook-up wire, &c.



Here is the circuit. As will be seen, it is as nearly as possible equivalent to the battery circuit described last month.

the normal manner, and as such its ...ical place is with the power unit. If you work out the connections with ...e speaker separate, you will strike ...kward wiring, because you will have ... double backwards and forwards from ...eaker, to power supply, to set, and for- ...it the flexibility of the alternative bat- ...ry operation.

The way we have it, you can make up ...o handy little boxes, connected to- ...ther with a single cable, and spaced ... few feet apart, which will match in ...hape and size. One for the set, and ...e for the supply.

Incidentally, this idea is applicable ...st as easily to any other type of ...rcuit as well as to this particular one.

HE CIRCUIT

The circuit commences with an R.F. ...age, using a 6U7G on its equivalent. There is a sensitivity control here, to ...t down the R.F. gain on ...rong locals. The usual ...ethod of doing this is to ...ary the bias on the valve. ...his procedure can be ...dopted as an alternative ...o varying the screen volt- ...ge. We stuck to the ...tter, because, you remem- ...er, we promised to make ...he A.C. version similar to ...he battery receiver. For ...his reason, we used the ...ame chassis and components ...or both sets.

The screen voltage we ...btain from the junction of ...wo resistors, wired across ...he 250 volts supply. This ...voids using a voltage ...ivider in the set—quite an ...tem when trying to simplify ...he circuit as a complete ...nit.

The 15,000 ohms re- ...istor should preferably be a 5 watt type, although a 3 watt or even a 2 watt may be used at a pinch. Higher values would be permissible, as long as the voltages were divided in the same proportion. If you have a 25,000 ohms voltage divider on hand, this could be used in the A.C. set. For battery work, with, say, 150 volts, the values could be made higher to prevent too much waste in the divider. If you like to go to a 6-pin socket, you could use a tapping for this voltage at about 100 volts.

DETECTOR

The detector is of the screen-grid type for best gain, with screen control of reaction. The voltage for this screen is also obtained from the junction of the two resistors.

We prefer this method to the condenser reaction, although the latter can be tried out if you like to experiment.

Transformer coupling is used back to the R.F. amplifier, the coils being similar to those used for last month's battery version.

A note about the grid leak. We remind you here of an old tip we discovered many years ago—that of shielding the condenser and leak. Failure to do this will probably result in hum being picked up in this part of the circuit. The high value of grid leak—you can even try 5 megs. if you like—explains this possibility.

By using a valve can for the detector, and tucking the smallest components you can get underneath it, all should be well.

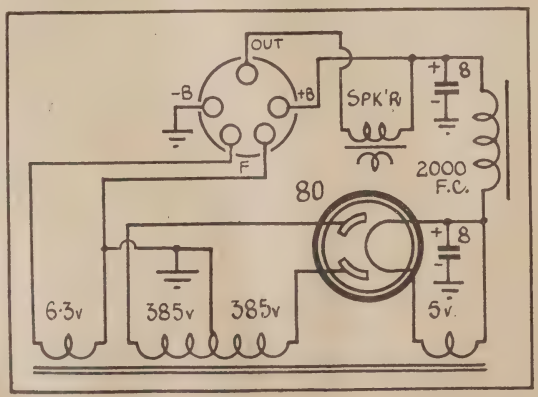
DECOUPLING

It is almost certain that decoupling will be required in the plate circuit of the detector. First of all, it is very important to keep hum from this part of the set, particularly with reaction, and, secondly, we want to keep the plate voltage as constant as possible.

Variations in power supply voltage, as will occur at any great volume, will probably cause unsteadiness to appear in the detector circuit. The use of a large condenser, as much for its reservoir action as anything else, should effectively prevent any such tendency.

AUDIO STAGES

The first audio amplifier is a conventional type—we used the 6C5G—resistance coupled to the detector. Any equivalent type could be employed in this position. The volume control is in its grid circuit. There is no special need to decouple this



The circuit of the combined power supply and loud-speaker unit. Standard components are used.

valve in the plate circuit.

The output valve is a pentode of the 6F6G type, or equivalent. As can be imagined, there is rather high amplification in the audio end, and it will bring up signals to a very high level.

A condenser of .005 mfds. could be wired across the output of the pentode as a precaution against R.F. voltages causing feedback.

In this connection, we have shown a .0001 mfds. condenser bypassing the detector plate circuit. Another condenser of the same value, or even higher, can be wired from the other end of the R.F. choke to earth, should instability worry you. We didn't find it essential, but there's no harm in having it there.

You will notice that in the wiring diagram we have included a .1 mfds. condenser across the high tension. This, again, is a component well worth having, as many electrolytics are not altogether the best R.F. bypasses, and, in any case, the lead to the power supply might be a long one. All these points we mention to answer possible questions about what to do if little troubles are experienced. Many sets will not need them, but others may.

This .1 condenser can be increased in value up to .5 mfds., if you have one on hand.

TUNING GANG

The tuning gang we used was cut down from a standard 2-gang type we bought for a few shillings.

If you remove the rotor plates by unscrewing the back bearing you can easily take the rotor right out altogether.

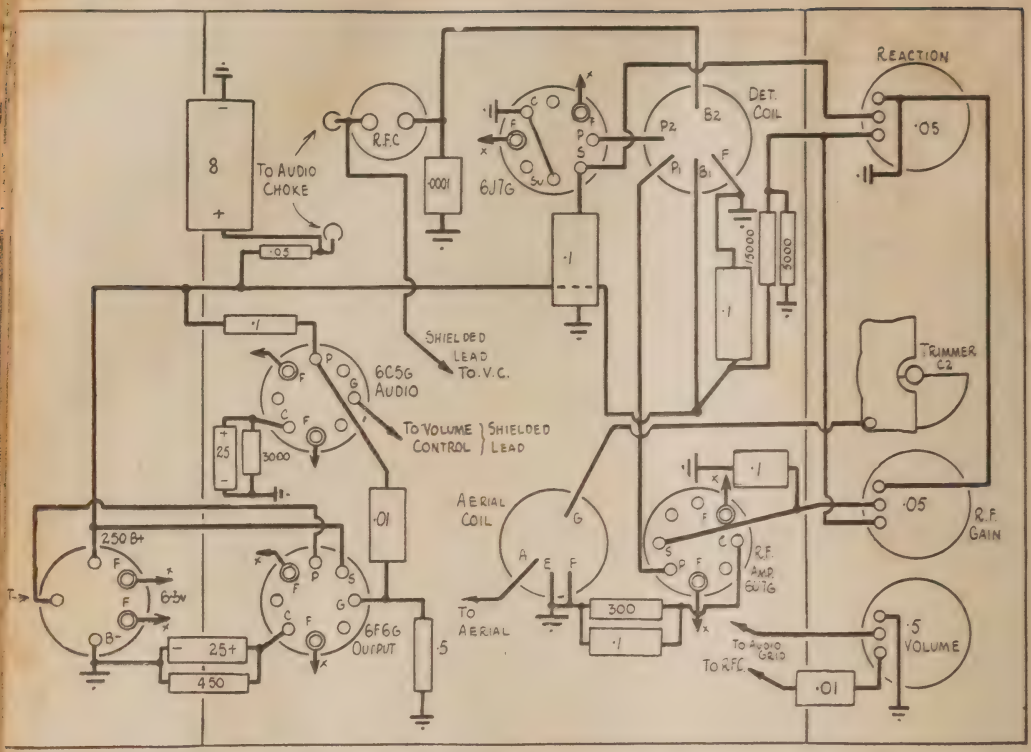
The ordinary gang is about .00038 mfds. in capacity. One-third of this is just over .00012. Thus you will remove two-thirds of the plates, leaving the other third intact.

If you first cut the bonding piece at the tip of the plates, you can pull out the unwanted ones quite easily with a pair of pliers. The fixed plates don't need touching.

The rotor then goes back into place. Screw up the back bearing just tight enough to allow the rotor free movement without actually binding. The earthing strips when put back into place will provide the necessary friction to stop the rotor being sloppy.

Incidentally, these should always be connected direct to the chassis under the gang. The other side of the bolt under the chassis can then be used as a central earthing point for all bypass circuits. This includes also the earth return leads of the coils. Don't just earth these to the chassis anywhere at all, and hope for the best. The return through the chassis is actually part of the tuned circuit, and may couple itself into other parts of the set.

You may be able to buy a gang ready made for the right capacity. Failing this, you could gang two midgets of 100 mmfds. or more capacity, and use these. You will probably be able to cover 16 to 31 metres quite easily with them, and now that there are no amateurs on the 40-metre band, at least in Australia, it isn't so important to reach that wavelength.



Here is the wiring diagram. It includes one or two small components which are mentioned in the article as being optional. The space between reaction control and aerial trimmer may be filled by a tone control—optional but useful.

COILS

The coils are wound on standard plug-in formers, and are mounted in valve sockets raised up a little from the chassis with spacing pieces. The lead to the grid sections from the grid ends of the coils thus runs above the chassis. The valves connect into the tuning circuits by running leads from the grid clips to the top solder lugs on the respective gang sections.

THE DIAL

We used a standard type of panel-mounting tuning dial on the set, which is probably similar to one you may already have. A larger back-panel dial could be used, and hand-calibrations marked on a sheet of thin cardboard placed over the glass. Make sure you work your layout to suit such a dial, which may need a slightly deeper chassis to allow for its own depth. However, the front panel types are quite satisfactory, and, of course, you can fit a calibration scale over the present numerical markings, if you wish.

POWER SUPPLY

A standard type of power transformer is used, of 60 or 80 mills. The loudspeaker may be any type small enough to fit on the chassis—naturally you won't want a 12 inch type! The smaller jobs are quite sensitive these days, and when the unit is in a small cabinet will give tone quite good enough for normal shortwave purposes.

We used a couple of small tubular 8 mfds. filter condensers, but the can types would be just as good. You'll find plenty of room for them on the chassis.

COIL WINDING

The coil data we have given is intended as a guide to start you on your way. The turns are exactly those used with the original set. The primary of the R.F. transformer, as well as the reaction winding, may be slipped up and down the former to vary the coupling as required. The positions of these windings will have a definite effect on reaction. Too close primary spacing will make reaction hard, as will too much spacing of the reaction coil. At the same time, best volume will be obtained with the primary coil not more than about 1-8inch from the secondary. You can try various positions to get best results.

Too close spacing of the primary will couple the detector too tightly to the R.F. amplifier, and possible interlocking of tuning may result.

You can also experiment with the spacing of the aerial coil on the same principle.

Be careful here, for strong locals will be harder to handle if the aerial coil is overcoupled, particularly when using a long aerial.

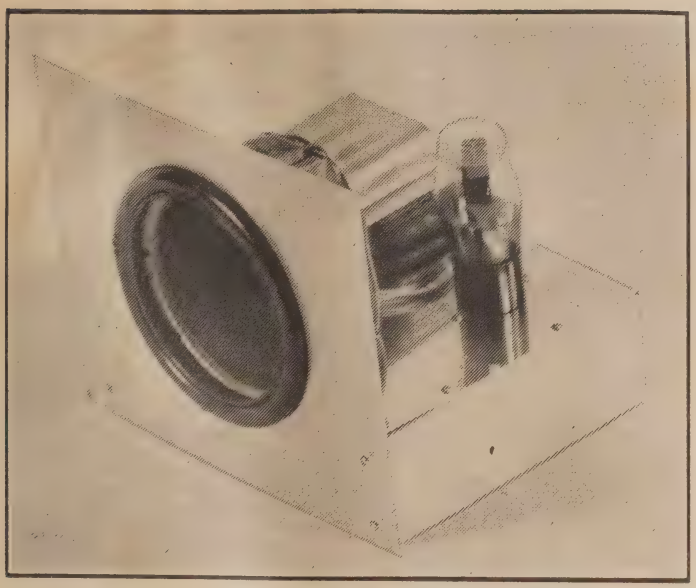
However, now that amateur stations are, unfortunately, off the air, you are not likely to be troubled with many strong locals. The absence of amateurs, of course, will mean so many less interesting stations to listen to when things otherwise are quiet, although the Americans on 20 metres still broadcast, and are receivable in the afternoons and evenings.

There is not much else we can say to help you with the set. The wiring diagram and circuits illustrate everything fairly well. The set has no particular tricks, and does its work as well as any T.R.F. receiver can expect to do.

We would be glad to help you over any troubles encountered in practice, and will endeavor to answer your questions as soon as possible. If you want the quickest answer, ask for it to appear in the columns of "Wireless Weekly." Sometimes we can get it there sooner than in "Radio and Hobbies," although our mail-bag, unfortunately, for our working hours, is already very heavy.

WINDING THE COILS

These are wound on 6 pin formers, to be standard. The detector coil for 16-40 metres has 5 turns plate close-wound, 8 turns grid, spaced about the diameter of the wire, and 8 turns, reaction. Plate and reaction coils are about one-quarter inch away from the grid coil. Wind plate first, then grid.



A front view of the power-speaker unit. The speaker may either be mounted on the chassis itself or bolted to the panel—the former for preference.

then reaction. Connections in order from the bottom will be, plate, earth, filament, grid, detector plate, and audio choke.

The aerial coil will have about 7 turns on the grid, and 5 on the aerial. Connections in order, are aerial, earth, grid and filament.

It is a good idea to make aerial, plate, and reaction windings so that they can be slid along the 1¾-inch formers, to find the best spacing. Use wire about 26 gauge silk covered, or enamelled.

To tune higher than 40 metres, try doubling all coil sizes, except reaction, which can probably remain the same. Add or remove turns, one at a time, until you get the right coverage. Slight adjustment to the turns we have already given might be required to get exact coverage.

The set is not particularly suitable for lower wavelengths, although you may be able to get it working down to 10 metres, by careful pruning of coils. Dimensions will probably need to be halved for this band.

GROUNDING

We have already referred to the need for good ground connections in the receiver. If possible, make all the earth returns to each stage to the same point on the chassis. The spot where the earthing pieces of the gang are connected to the chassis is a good one, and possibly you can make most of the earth return circuits centre round it.

In any case, when finished, connect all the earth points together with straight pieces of 18 gauge tinned copper wire, and run another such length direct to the earth terminal.

You will then be sure that the earthing is well and truly done. It is not a good idea to rely on the chassis alone in a short wave set.

The aluminium chassis is better in this regard than steel, but the surface of the metal may corrode in time, and a poor joint might result.

With a steel chassis, should you use one, the earthing network should be regarded as a necessity. It is better to put up with a rather untidy-looking chassis from beneath than to have an inefficient set. Therefore, if you can save length in any leads by running direct, do this. No one is going to look under the chassis, and pretty looks won't help you much if the results are not there.

You will note, by the way, that our set uses a 6F6 instead of a 6F6G. This was simply because we had one of these metal valves on hand, and doesn't indicate any particular preference for it over the type specified.

AERIALS

Most people these days realise that long aerials are not the best for short wave reception. Far more important is the height of such an aerial above the ground.

In the case of a T.R.F. set, the matter of the aerial length should be more carefully studied than is necessary with a superhet.

It is possible to do wonders with a comparatively short indoor aerial, if the general locality is a high one, but, as a general rule, some trouble should be taken to get the aerial as high as you can.

Height is far more important than length. A low, long aerial may not show much increase over a medium length one of the same height, but it will have quite an effect on the R.F. stage, because of the extra loading it will impose. This, thrown across the tuned circuit, will first of all make it very much broader,

secondly, it will tend to reduce the -all gain.

h the other hand, a short but high al will not create trouble through aerial loading, and will be a better gy gatherer than the longer one.

s a rule, an aerial of about 60ft. all, including lead in, should be t the best compromise between the providing it is at least 30ft. from ground.

pecial aerials are often used for rt wave sets. These are just as suit- for the T.R.F. design. The com- est of these is probably the doublet , which has two connections to the

an aerial of this type is used, the of the aerial winding which we e shown as being connected to the und should not be actually ground- A second aerial terminal should be vided, and the ends of the doublet uld be connected to them.

separate terminal should then be vided for an earth connection.

ncidentally, a doublet aerial is fairly ectional, and should therefore be ing so that it is at right angles to direction from which reception is uired.

ts length will also govern the wave gth most favored. The length of h side of the doublet to resonate at metres would be about 15 feet. Gen- lly speaking, an aerial which has t. per side would be about the best -round type to use.

BROADCASTING THE TIME SIGNAL

(Continued from Page 7)

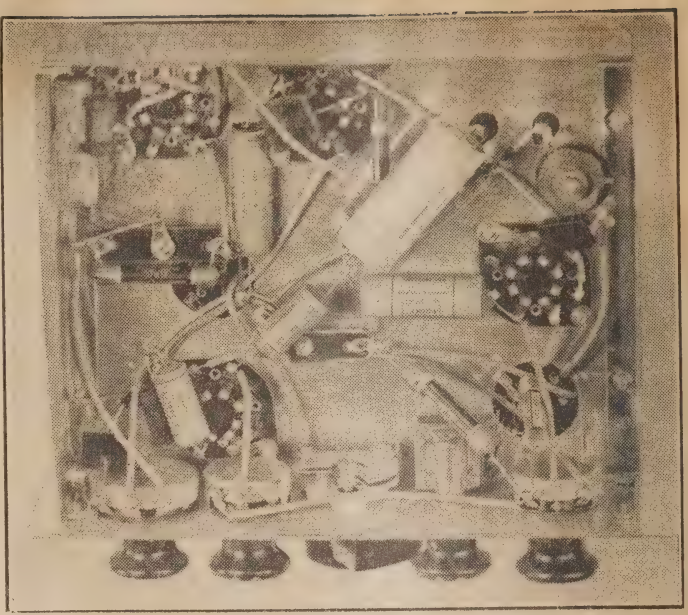
hich is not receptive to impulses of ration of less than half a second and therefore not affected by the dots hich constitute normal Observatory nals. In the event of a false pulse duration exceeding half a second, s circuit operates, restoring the equip- ent to normal and at the same time erating a signal lamp, which warns e operator of the fault.

The various studio announcing posi- ons are equipped with signal lamps hich indicate the approach and trans- ission of the time signal.

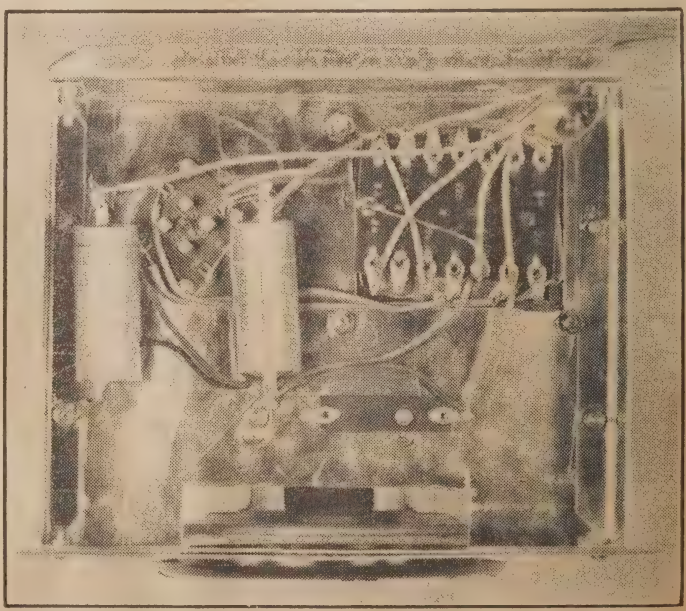
The equipment is built on a standard oadcast type of chassis, which is ounted on one of the control room eech input cabinets. It occupies a anel space of 8¾inches by 19 inches ide. The only control on the front is switch which enables the time sig- al to be suppressed if this is desired any time. Two signal lamps are pro- ided—one indicating normal opera- on and the other, which is colored ed, indicating improper operation.

Accessible from the rear are controls or adjusting the time delay circuits and he volume and frequency of the signal upplied by the oscillator valve. These re adjusted initially by an engineer and eed no further attention.

The rotary line switch and relays re standard telephone type equipment, anufactured by Automatic Electric elephones. Ltd., 229 Castlereagh treet, whose engineers provided valuable o-operation in helping to solve some f the problems associated with the de- ign of the apparatus.



There is plenty of room under the chassis for everything. Note that we still have the battery switch which was used in the battery version. It is not connected. A tone control may take its place.



Beneath the power-speaker unit. Tubular electrolytics are used, but can types would be equally suitable. This unit could be used with other receivers if desired.

AMATEURS WILL CARRY ON TRAINING MORSE OPERATORS

Although not permitted to use their transmitters for the time being, the amateurs of N.S.W. are not suspending activities. The Wireless Institute of Australia is planning, among other things, to commence Morse Code classes with a view to improving the operating standards of its members.

SATURDAY, September 2, 1939, will live always in the minds of amateur experimenters and transmitters throughout the Commonwealth of Australia. Upon that day amateurs realised by a communication from the Director-General of Post and Telegraphs, Sir Harry Brown, that the Mother Country intended honoring her pledges given to other countries.

The first thought in the minds of many amateurs was "what part will amateur radio play in this upheaval?"

The Wireless Institute of Australia, both State and Federal, have been organising for quite some considerable time to meet such an emergency as this.

Members of the institute throughout Australia belong to the Royal Australian Air Force Wireless Reserve and it was not very long before these men reported for service to various bases.

In addition to the R.A.A.F.W.R., this State also has members in the Volunteer Coastal Patrol.

The institute has offered the services of those members who do not belong to either of the above services to the P.M.G.'s Department.

The institute feels that the many well-trained operators who constitute its membership, should prove of value in an emergency such as this.

It has been suggested to the department that each division should undertake a co-operative scheme of monitoring frequencies between 1500 kc. and 56 mc.

Again, the institute is ideally equipped for the training of operators who would prove useful to the various services in time of war.

Here in New South Wales the formation of these classes has already begun and any member of the signal section of any arm of the forces or any person willing to serve in a communications branch if called upon are asked to get in touch with the secretary, Wireless Institute of Australia, New South Wales Division, Box 1734JJ, G.P.O., Sydney, as soon as possible.

If amateur radio should become disorganised during the present crisis, it is felt that some difficulty may be encountered, upon the cessation of hostilities, in holding the amateur bands and the re-issue of experimental licences.

The institute is making every endeavor to maintain the present organisation and be in a position to speak on behalf of the amateur in the future as it has done in the past. The usual monthly general meetings will be held and, although lectures will have to be more or less limited to receiving and allied subjects, it should be realised that no little importance is attached to th branch of the hobby. After all, a efficient transmitter is useless to large degree unless the receiver is al an instrument of no mean engineerin skill.

It is quite safe to say that when th last shot has been fired it will be foun that, as in the last conflict, the amate has played his part nobly and has live up to his greatest traditions. May th day soon come when they are once mo united in the great brotherhood "Hams."

GLOSSARY

STAGGER

REFERS to the overhang of the to wing of a biplane over the lowe wing. When the lower wing project in front of the top wing, the biplan is said to have negative.

HYDROPLANE

A WORD **wrongly** used to denote seaplane. The word should be hydro aeroplane. A hydroplane is a type o speed-boat.

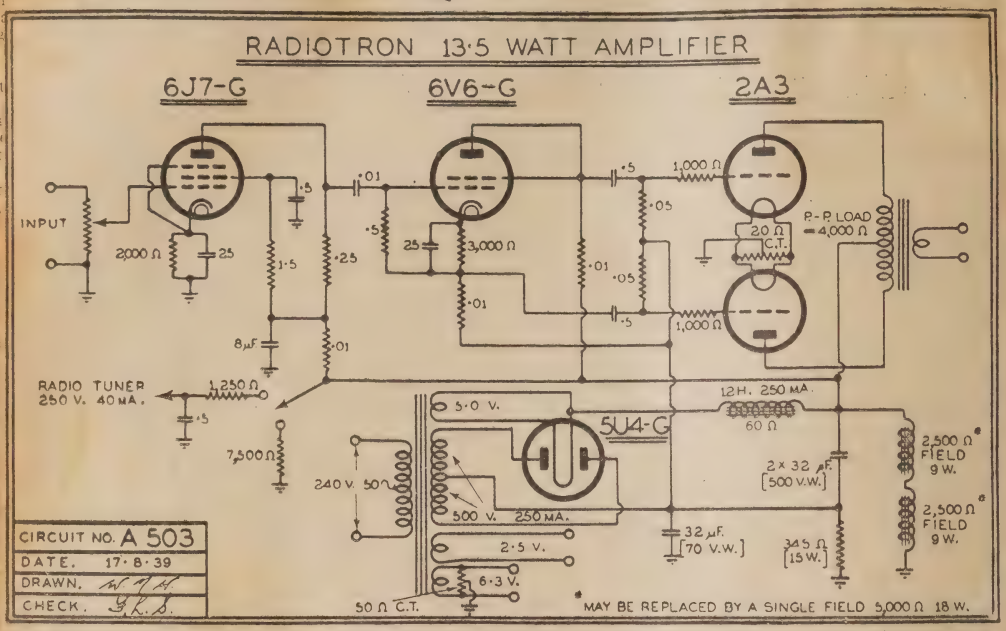
FORMED

SOMETIMES called bulkhead. Th word describes the shaped mould which go to form the internal structur of an elliptical or circular fuselage. Th cross section of a fuselage depends o the shape of the formers.

MONOCOQUE FUSELAGE

A FUSELAGE, the covering of whic is rigid and so obviates the need fo any internal structure save a forme or two to maintain the cross-section.

A NEW HIGH-QUALITY AMPLIFIER



Here is the circuit of the new amplifier.

THE characteristics of Radiotron 2A3 are such that two valves, operating in push-pull class AB1, can, under fixed bias conditions, deliver a power output of 15 watts with 5 per cent. total harmonic distortion.

Since the plate current varies with the input signal, from 80 mA. at no signal to 140 mA. at maximum signal for two valves, there is obvious difficulty in applying self-bias. If the cathode resistor for self-bias is designed to provide the correct bias with no signal input, the bias developed at maximum signal input will be greater than the optimum.

On the other hand, if the cathode bias resistor is designed to give the optimum bias at maximum signal input, then the bias with no signal input will be so low that the maximum plate dissipation will be exceeded.

THE BIAS RESISTOR

The procedure which is adopted is, therefore, to design the cathode bias resistor to give the same plate current at no signal input as is given under fixed bias conditions, and to adjust the value of the load resistance to give maximum power output for limited distortion without exceeding the plate dissipation at maximum input.

The reduction in power output is not due to the variation in plate current over the cycle, for it is assumed that the cathode bias resistor is adequately bypassed, but to the restricted choice of operating conditions.

Even if the valves were operated at a fixed bias equal to that produced by the self-bias resistor at maximum signal, and with a load resistance as for self-bias, the performance as regards power output and distortion would be the same as for self-bias.

> This circuit originally appeared in the 100th issue of Radiotronics. The care which has been taken in its design should guarantee excellent results if the circuit is rigorously adhered to. May we take this opportunity of congratulating the A.W. Valve Co., in reaching the 100th issue of their fine publication.

The maximum power output for self-bias operation of 2A3's in class AB1 is 10 watts with 5 per cent. total harmonic distortion; for 2.5 per cent. distortion, the output is necessarily less than 10 watts.

Although the higher power output is desirable, it is usually difficult in a practical amplifier to provide a convenient source of fixed bias. However, by arranging the circuit so that the bias is not entirely dependent on the plate current, it is possible to effect a compromise between the two conditions and to realise a power output of approximately 13.5 watts.

In this circuit (A.503) the required bias voltage is developed across a back-bias resistor by the plate current of the output valves, the energising current of the speaker, and by the supply current of the radio tuner.

PREFERABLY ADJUSTABLE

The back-bias resistor should preferably be adjustable, so that due compensation may be made for normal variations in load current. The no signal bias should be set to minus 62 volts, preferably with the radio tuner set to a local station and drawing normal current.

In the experimental amplifier, zero signal current through the resistor was 181 mA., which rose to 209 mA. at full output.

When no tuner is used, an equivalent amount of current should be drawn from the power supply by connecting a 7500 ohm, 15 watt resistance between B plus and earth.

Under semi-fixed bias conditions, the maximum permissible resistance in the grid circuit of a 2A3 valve is intermediate between .05 and .5 megohm, but in this amplifier it was found possible to maintain the grid resistors at .05 megohm without compromising the performance.

The 1000 ohm resistors in series with each grid lead serve to relieve the severity of the distortion when the out-

put valves are momentarily driven into the grid current zone.

For full power output, the valves require a peak input voltage of 144 volts (grid to grid). The rated power output is measured across the primary of the output transformer.

The power which can be taken from the secondary is, of course, dependent upon the efficiency of the transformer.

PHASE SPLITTER

In order to reduce the number of valves, it was necessary to find a phase splitter which was capable of fully exciting the output valves without an intermediate stage of amplification.

Investigation showed that, of the valves available, type 6V6-G connected as a triode is most suitable, and may be used to provide the necessary output voltage when connected across the full 360 volts available from the power supply. Accordingly, the cathode return is made to the centre tap of the power transformer instead of to earth. The connection is unorthodox, but quite in order, and provides an additional 60 volts for the valve. Tests showed that the 6V6-G commences to draw grid current as the output of the amplifier reaches 14 watts.

In this application the plate current of the 6V6-G is approximately 7 milliamps, and the 10,000 ohm load resistors may, therefore, be of 1 watt rating. The self-bias resistor in the cathode circuit is comparable in value to the load resistor and is by-passed to avoid unnecessary degeneration.

In cases where the value of the bias resistor is very small in comparison with that of the total load resistance, such a precaution is unnecessary. With the by-pass condenser in position, the gain of the stage from input to either grid is 0.78.

Further information on the triode operation of type 6V6-G is given elsewhere in this issue.

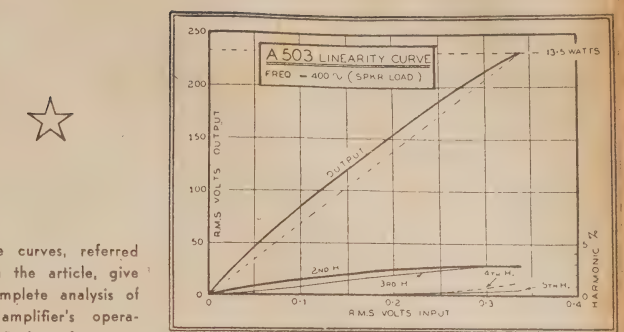


FIG. 2

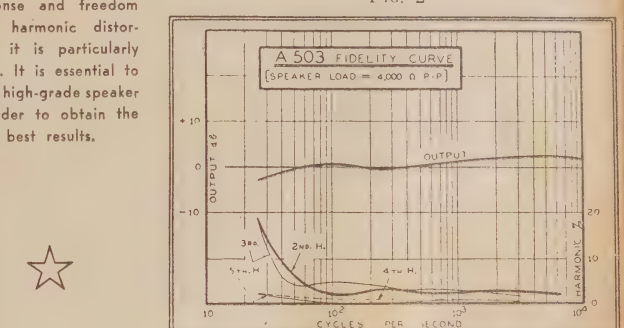


FIG. 3

These curves, referred to in the article, give a complete analysis of the amplifier's operation. Both in frequency response and freedom from harmonic distortion, it is particularly good. It is essential to use a high-grade speaker in order to obtain the best results.

AMPLIFIER CHARACTERISTICS

R.M.S. Input Voltage for Full Output	0.34 volt
2A3 Plate to Fil. C.T. Voltage (no sig.)	300 volts
2A3 Plate to Fil. C.T. Voltage (max. sig.)	280 volts
2A3 Grid Bias (no sig.)	-62 volts
2A3 Grid Bias (max. sig.)	-72 volts
2A3 Plate Current (2 valves no sig.)	80 mA.
2A3 Plate Current (max. sig.)	112 mA.
Total Amplifier Current (no sig.)	188 mA.
Total Amplifier Current (max. sig.)	216 mA.
Hum Level Below Full Output	-60 db
R.M.S. Plate to Plate Output Voltage (full output)	232 volts

GENERAL

The remainder of the amplifier is straightforward and does not call for special comment, being generally similar to the original amplifier featured in Radiotronics 78.

The general characteristics are tabulated here and are self-explanatory. Figures 2 and 3 show, respectively, the linearity and response curves, which were taken with the amplifier operating into a pair of typical 10-inch speakers. The curves can, therefore, be taken as indicative of the performance which can be expected under normal service conditions. It will be seen that the curves for linearity, response, and distortion compare favorably with those given for the earlier amplifier.

Radiotron 1D8-GT Diode-Triode-Power Pentode

New Type For 1.4 Volt Receivers

RADIOTRON 1D8-GT is a multiple valve intended especially for operation in battery portable receivers. It combines in one envelope the performance of two separate valves, and thereby saves space as well as having other outstanding advantages.

The diode-triode unit is somewhat similar to type 1H5-G, except that the amplification factor is lower. The gain is still, however, ample for portable receivers, since excessive audio frequency gain is undesirable on account of microphony. Zero bias operation is permissible as with the 1H5-G. The circuit arrangement and values of components may therefore be the same as for type 1H5-G.

The pentode unit may be compared with type 1A5-G so far as the filament current is concerned, but the power output is 200 milliwatts, as compared with 115 milliwatts for the 1A5-G.

This increase in power output has been achieved at the cost of a very slight increase in plate and screen currents. The cathode current is only 6.0 m.a., compared with equivalent values of 9.1 m.a. for the 1C5-G and 11.1 m.a. for the 1Q5-GT. The grid bias is higher than for these types thus causing some loss of sensitivity and also a loss of effective plate voltage when back-bias is used.

The whole unit is mounted in a T-9 bulb having overall dimensions 3 5-16in. in length and 1 5-16in. in diameter, and is thus shorter than type 1A5-G.

Round the Trade

NEWS AND NEW RELEASES

IMPROVED E.T.C. POTENTIOMETERS

LATEST DEVELOPMENTS

DESIGNED to necessitate a minimum of service, the improved E.T.C. potentiometer range sets a new standard of efficiency in what is probably the most over-worked component in the modern receiver. Performing two or three functions, as many high-resistance potentiometers are called upon to do, and handled with the inexpertness of the average listener, it is obvious that the control must take a lot of punishment and show consequent ill-effects unless very carefully designed and constructed.

ELEMENT

Laboratory tests of 50,000 rotations show only 10 per cent. variation from the original value of the resistance element. With extremely low temperature and voltage co-efficients, and absolutely unaffected by relatively high humidity conditions, the elements will stand a tremendous amount of hard wear. The taper on the element is logarithmic, that is, at 50 per cent. of the rotation the resistance value is 10 per cent. of the total—permitting the control to be adjusted to produce fine and gradually increasing volume. The overall tolerance is plus or minus 20 per cent., and the wattage rating is very conservatively calculated at 1 watt.

CONTACT ARM

The use of a new nickel silver alloy in the contact arm permits the use of a lighter gauge arm, and gives an improved contact between the contact roller and element. A definite tension adjustment during assembly of exactly .190 grammes tension, on the contact roller, nullifies possibility of element dents and lengthens the rotation life of the control.

GROUND RING

This unit is now made of nickel silver, specially treated to give a soft but precise movement, and to decrease contact resistance.

BAKELITE PLATES

The back plate of these two units is now made of 1-3rd heavier bakelite, which minimises any chances of warping, increases the rigidity, and makes a more perfect base for the attachment of the element.

GILBERT ELECTRIC FANS— JOHN MARTIN'S STOCKS

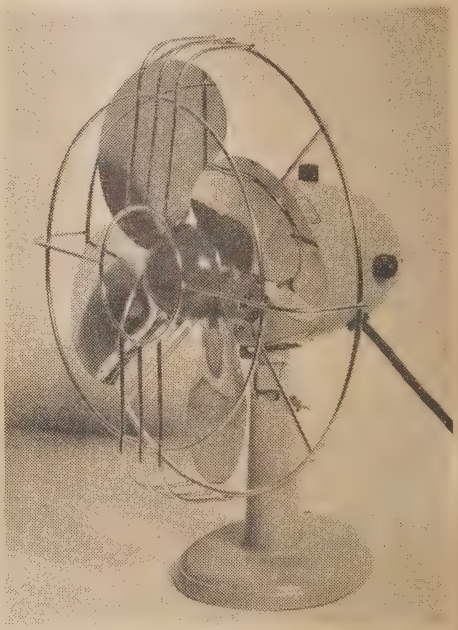
A particularly good line of electric fans may be seen at John Martin's, in Clarence Street. These bear the name "Gilbert"—well-known in U.S.A. as manufacturers of electrical motors and equipment.

The Gilbert fan combines a nice balance of clean finish, ruggedness, and smooth operation.

Special "wind-duck" blades are used to give the greatest possible air displacement. There are 10 inches in diameter.

An oscillating clutch is provided so that the fan may be used as a double-purpose type.

Model A325 sells for £3/17/6, and should prove an excellent seller for the coming season.



BUSHING

The bushing is made of a special brass alloy, ensuring a smoother rotating action. The method of riveting this unit to the mounting plate has been changed, any possible chance of disintegrating being prevented by "castellated" riveting.

TERMINALS

The terminals are now made of a lighter gauge brass, more heavily silver-plated than formerly. A new improved method of riveting is employed in fixing them to the control element, giving a lower contact resistance and eliminating loose lugs and broken contacts.

SPINDLES

These are now made of closer tolerance drawn steel rod, and are hand-fitted in the bush during assembly, so as to give a working clearance of .0005 inch between the bush and the spindle.

ACTUATING PIN

This unit is riveted by a new method to the contact arm insulator and contact arm, the rigidity of the complete assembly being considerably increased.

THE ROLLER

A completely dust-free surface element is ensured by the exlusive design of the roller, while further protection is given by a dust-proof shield. A pressure of 190 grammes is maintained on the roller, but the opposing carbon element, because of its quality and construction, withstands the pressure.

The testing of the complete unit is under expert supervision, and the instruments used for testing have been specially designed to give an overall gain of 60 db. on a specially-equipped plus or minus decibel meter. The audible side has an extra amplifier gain of 80 db., so that any electrical or mechanical defects are readily apparent.

LATEST AMPLION SPEAKERS

The Amplion electrically-welded 12in. "V" series loudspeakers are specially designed to handle large outputs without distress. Until the advent of this type of speaker, units for power outputs of 10 to 20 watts were expensive.

The Amplion model V, retailing at 29s (a lower cost than previous standard 8in. types), is rated by the manufacturers at 10 watts undistorted power output with a maximum of 15 watts. This is quite an advance in speaker design, and, it is claimed, a function only allied to the electric welding of the complete speaker and its magnetic circuit.

TYPE "VL"

The Amplion type "VL" is a heavier 12in. model than the "V," and is capable of power outputs of 13 watts undistorted and 20 watts maximum. Still greater outputs are claimed for the "VP3," a similar-sized speaker with a 64oz. permanent magnet; this will handle 20 watts undistorted and 30 watts maximum. The electro-dynamic type "VL" is listed at 47s 6d, and the "VP3" permag. at 110s.

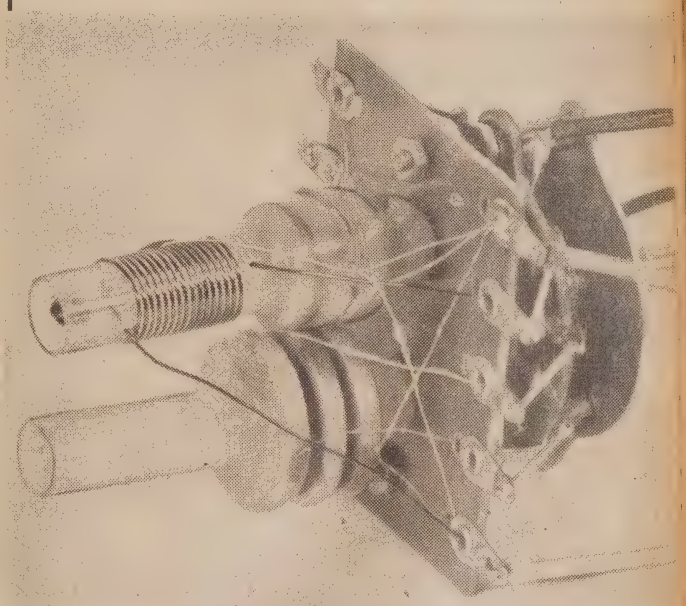
All "V" series speakers are similar in mechanical construction; most notable is the complete lack of belts or rivets to clamp pole-plates or magnet yokes to the cone housing. The cone housing, outer pole-plate and yoke are butt welded into one homogeneous unit. The inner pole is removable for the purpose of inserting different resistance field coils should they be desired, and this can be done without removal or damage to the cone.

The magnetic path to the air-gap, in which the voice coil is permanently centred, is a perfect one without losses due to minute air-gaps, as found in bolted or riveted assemblies. The efficiency of the "V" series is thus very high, and since the welding allows of much closer tolerances than usual, the annulus has been reduced. This factor vastly improves the speaker's response to transients and high frequencies by means of a high degree of natural damping.

GOOD CHARACTERISTICS

The general result is that the Amplion "V" series speakers have improved and brilliant "highs," together with "lows," which lack boomy resonances. The overall characteristic is unusually flat. The "VL" and "VP3" types have a high-fidelity response extending over a range which permits coverage greater than 40 to 7500 cycles-per-second. All "V" series Amplion speakers are 100 per cent. dust-proofed, with external concentric spider, and fitted with isolated core tropically sealed transformers. Plug and cord are supplied, and all standard fields and input transformers are available. "VL," "VP2," and "VP3" input transformers have 65 ma. continuous current rating. The "V" and "VP1" transformers are rated at 50 ma.

OSCILLATOR COIL UNIT



Suitable for A.C. or battery-operated oscillators.

RADIO EQUIPMENT PRODUCTS

With its fine range of useful test equipment, the firm of Radio Equipment Pty., Ltd. is becoming well known throughout Australia. Here are some details of apparatus in which they have specialised.

ILLUSTRATED above is the special coil unit used in the Battery Modulated Oscillator, described in our last month's issue of RADIO AND HOBBIES.

The coil unit, as may be seen, is a very well-engineered assembly, entirely wound on Trolitul, the newest and in many ways most effective insulating material for radio work.

The price of this unit is £1 7s 6d plus tax, and it is ideal for use when building all oscillators of this type, both battery and A.C. In last month's issue a full-page advertisement appeared for Radio Equipment, Ltd., from whom this unit is available, in which the sentence occurred:—"Part units for both A.C. and battery operated oscillators are obtainable at £1 7s 6d plus tax." Obviously this should read "coil units."

In this issue will be found an article supplied to us by Radio Equipment on the construction of an electric guitar.

Many people from time to time inquire regarding such an instrument which is becoming more and more popular for private and dance band use.

It operates in conjunction with a 6-valve A.C.-D.C. amplifier, details of which will be found in the article.

The name of the unit is "Electrotone," and not "Electrone," as was stated in this advertisement.

The electric guitar may be obtained either ready built or in kit form from Radio Equipment Pty., Ltd.

ELECTRO-VOICE MICROPHONE

AMPLION HAVE STOCKS

Among the higher quality microphones, such as are used for studio and broadcast work, the dynamic type has always been popular. Amplion's Electro-Voice is a fine example of such a unit.

The Electro-Voice Dynamic Microphone.

MANY useful and valuable features are to be found in the New Era Dynamic microphone known as the "Electro-Voice 620."

The frequency characteristic of the microphone is wide and flat, without resonance in the middle register, while a reversible head, swinging through an angle of 180 degrees, allows a wide range of adjustment.

It is removable from the stand in less than 15 seconds.

Careful selection of raw materials provides highest efficiency and long life. Zamak die-castings having a tensile strength of 40,300 p.s.i. and an impact strength of 20 ft. lbs. are used for the case and studs. The magnetic circuit is constructed of Armco S.S. magnetic iron. A large Alnio magnet supplies energisation.

Frequency response, 40—10,000 cycles, with slightly rising characteristic. Output—55 db., open line. Each instrument furnished with 20ft. of low capacity cable (.00066 mfds.). Special transformer mounted in the case. Weight, 2½lb.

The Electro-Voice is obtainable in 200, 500 and 50 ohms impedances, or a high-impedance type may be supplied for direct connection to amplifier grid.

BUILD YOUR OWN MIKE WITH PARTS FROM MURDOCH'S

ONE of the advantages of the simple carbon type microphone is its low cost, easy connection, and if carefully built—good results.

Of all the carbon mikes available, the well-known "Transverse Current" type is still a firm favorite, and is found in many places where such a microphone is suitable.

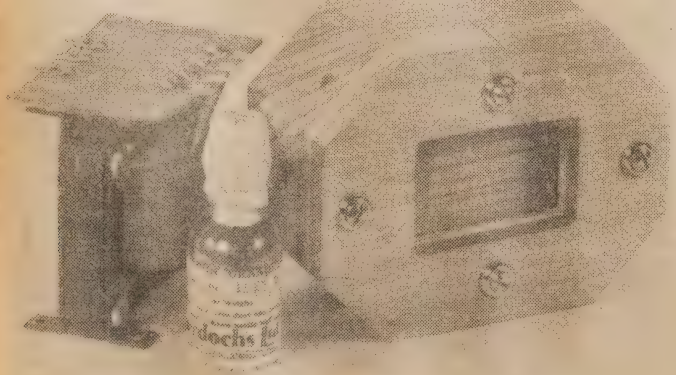
Murdoch's of Park-street, Sydney, have always found a ready sale for a kit of parts to build an excellent "transverse current" microphone, which is capable of giving very fine results. Construction is not at all a difficult business, particularly as the kit contains everything necessary for the job.

The base for the microphone is of teak, and is held together by the screws at the front. It comes in three sections. All the cutting of the wood has been already completed, ready to take the carbon granules.

These have been specially selected, and as our photograph shows, the correct amount included in the glass container. The electrodes and other sundries are also included.

A special microphone transformer is supplied with the parts, matched to the instrument when completed.

Murdoch's radio department can supply these kits immediately, as well as practically any other type of radio component, for receivers, test gear, &c. A visit to the showrooms will be well repaid.



Here is the kit of parts for the carbon microphone from Murdochs.

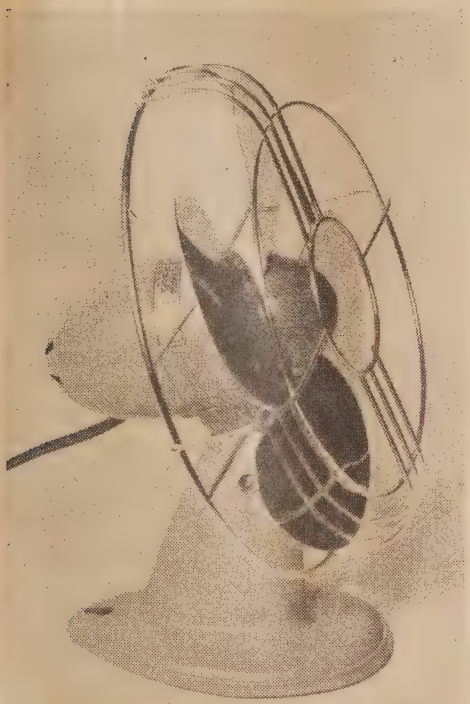
Improvements In Potentiometer Design

For those interested in the replacement market, the dimensions of E.T.C. Yaxley Controls are given. Overall diameter of the potentiometer case is 1¼ inches, and the total depth from flange of the mounting bush is 5-8th inch. With switch, the depth from flange of mounting bush is 1 1-8 inches. All units are of the single-hole mounting type, and require a 3-8-inch diameter hole; the maximum panel thickness which can be accommodated by the mounting bush is ¼-inch. The control shaft is standing ¼-inch diameter, ground flat on one side, and can be supplied in any length from 7-8 inch to 2¾ inches.

Further details of the range of E.T.C. Yaxley potentiometers will be gladly supplied by E.T.C. Industries, Ltd., 479-480 Elizabeth-street, Sydney.

DE LAUNAY HAVE POLAR ELECTRIC FANS

A POPULAR AMERICAN LINE



This natty little Polar fan is good value for the money, and has stood rigorous tests through sheer hard work. Just the thing for an odd corner through the hot summer months.

AN old favorite on the Australian market, and at no increase in price despite rising costs on all overseas merchandise, is the "Polar Cub" 8in. 240 ac., fan.

This unit has been a marvellous little quick-selling line for years, and with every indication of an early summer, dealers, storekeepers, etc., should acquire stocks now.

Priced retail at 29/6, complete with five feet of flex and packed in a solid carton, it is really remarkable value.

Suitable for either desk-table or for bracket mounting, it forms a great asset to any home or office.

The large type blades ensure great air circulation, and the enamelled centre cowl tends to make it a thing of beauty.

Despite its small size, the "Polar" fan is not at all likely to be tipped over by a sudden jolt, etc., a common failing in most small appliances. The reason for this is the heavy base. Finished in grey, it makes a striking contrast of the silver blades when they are in motion. A substantial discount is available to bona-fide resellers.

The wholesale distributors, Martin de Launay Pty., Ltd., are located at 287 Clarence-street, Sydney, and specialise in mail order despatch throughout the Commonwealth.

A MODERN MIRACLE

Every boy who is any sort of a boy has a hobby. It may be any of a thousand and one things, but it will surely show in what direction his mind works and helps to form his character.

If of a mechanical turn he will wan to know what makes the wheels g round now at the beginning of wisdon Then he will construct something the same sort for himself.

But the time comes when he ha to mark out his path in life, and, wit the help of his mother and fathe mostly, decide upon what he will tak up as a career.

One of the greatest scientific achieve ments of this age is the developmen and perfection of the Diesel engin This distinctive step forward has mad power.

There are great advantages in Hom Study by Correspondence, and the Aus tralian Technical Schools, Assembl Hall, Jamieson-street, Sydney (estab lished 1923), are now offering a complet Diesel engineering home study cours of training at greatly reduced rate under a very easy enrolment plan—pa as you learn. The course is under th guidance of experienced and highly qualified engineers.

SOCKET SET FROM NOCK & KIRBY'S

USEFUL in the radio workshop is th line of Duro socket sets on sale a Nock and Kirbys, Ltd., of George-street Sydney.

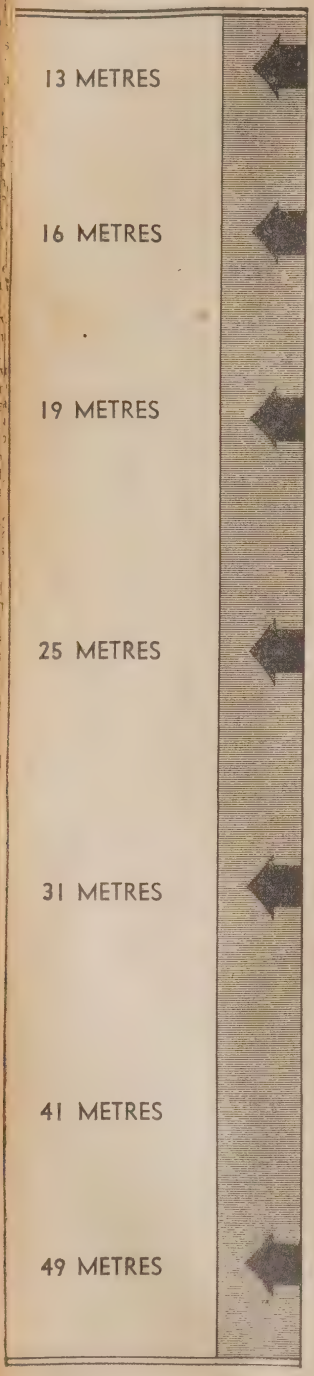
The set consists of eleven high grad pieces put up in a convenient black enamelled case as follows: 6½in. wood grip handle; 4in. L-handle; 3⅜in. ex tension adapter; ¼in., 5-16in., 3-8in 7-16in., and ½in. hexagonal sockets with ¼in. hexagonal drive, 3-8in., round knurled socket, and ¼in., and 5-16in square sockets.

This set is quite strong and can be depended on to give good and long service. Price 6/9 retail.

A smaller set, containing eight pieces may be obtained if desired. The price of the eight-piece set, complete with case, is 3/-.

Here is the bank of socket wrenches from Nock & Kirby's.

S. W. TUNING CHART



13 METRES.

GSJ 13.93 m. Daventry. 8.45 p.m. till 11.55 p.m.

GSH 13.97 m. Daventry. 8.45 p.m. till 11.55 p.m.

16 METRES

GSV 16.85 m. Daventry. 8.45 p.m. till 11.55 p.m.

GSG 16.86 m. Daventry. 8.45 p.m. till 11.55 p.m.

W2XE 16.83 m. New York. Heard from 9.30 p.m. onwards.

19 METRES

GSP 19.6 m. Daventry. 7.30 a.m. and 4.0 p.m.

GSO 19.76 m. Daventry. 7.30 a.m. to 9.0 a.m., also 9.20 a.m. till 11.30 a.m.

GSF 19.82 m. Daventry. 7.30 a.m. to 9.0 a.m.

GSI 19.66 m. Daventry. 3.0 p.m. till 5.15 p.m.

DJB 19.74 m. Berlin. Heard well in the afternoon.

DJR 19.56 m. Berlin. Also heard in afternoons.

YDC 19.8 m. Bandoeng. Good in forenoons, and excellent at night.

25 METRES

VLR3 25.25 m. Lyndhurst. Now being used again in daylight.

W2XE 25.36 m. New York. Has been heard well in late afternoons.

RNE 25.0 m. Moscow. Heard well at various times.

Radio Saigon. 25.47 m. Saigon. Good station late at night.

31 METRES

GSB 31.55 m. Daventry. 2.0 p.m. till 2.30 p.m. and 3.0 p.m. till 5.15 p.m.

DXB 31.22 m. Berlin. When on the air opens at 7.15 a.m.

DJX 31.01 m. Berlin. Good morning station.

2RO3 31.13 m. Rome. Excellent in morning, also Sundays 4.0 p.m. till 5 p.m.

YUC 31.58 m. Belgrade. Now good morning station at 7.0 a.m.

KGEI 31.48 m. Treasure Island. Good in afternoons, also after 10.0 p.m.

ZHP 30.96 m. Singapore. Good station every night.

41 METRES

CSW8 41.3 m. Lisbon. Good station in the mornings till 8.0 a.m.

TPB11 41.21 m. Paris. Also heard well from around 7.0 a.m.

49 METRES

Radio Saigon 49.05 m. Saigon. Very loud every night from 9.0 p.m.

KZIB 49.67 m. Manila. Another loud one at night.

HP5K 49.95 m. Panama City. Good on opening at 10.0 p.m.

DJC 49.83 m. Berlin. Still good in mornings at 7.0 a.m.

Due to the European situation many of the above stations may cease operations or change their operating times from those shown above, but the above is the position as we go to press.

OVERSEAS BROADCASTERS

ENGLAND.—From many of the Empire stations we have had very good reception, both on the regular sessions intended for this portion of the world and also from many of the other transmissions which have been given. Let me hope Daventry will continue on the air as a means of giving us first-hand information, which is of such vital interest to all in Australia and New Zealand.

U.S.A.—As mentioned elsewhere, the American stations gave a very full cover of the situation, which came in well from many of their stations which are not usually heard at such strength in this country. Perhaps best of these was KGEI and W2XE, though we also heard very good transmissions from WRCA, WBOS, and WGEA.

GERMANY.—All the usual German stations have been heard at good strength at various times of the day and night, and there have been additional broadcasts from some of their new stations such as DXB and DZF.

POLAND.—The Polish stations are, unfortunately, not heard to great advantage, but on favorable occasions one can tune in SP19 on the 19 metre band and also SP48 on the 49 metre band. On one occasion we heard quite an interesting news bulletin from SP19 at about 9.45 a.m. on 19.84 m.

FRANCE.—The best French station up to the present has been the one on 41.21m., which comes in at excellent strength in the early mornings, but there are also the two on the 25 metre band, TPA4 and TPB7, which give an English news session at 2.0 p.m. Also on the 19 metre band there is TPB6, which is heard fairly well at 4.0 p.m. As the summer advances, we should hear TPA2 on 19.68 at much better strength.

GUATEMALA.—Leaving Europe and its troubles an enjoyable programme of Marimba dance music can be heard through TGWA on 30.98 m. on Sunday afternoons, sometimes as late as 6.30 p.m.

DUTCH EAST INDIES.—The ever-popular station, YDC, has been heard at excellent strength every night, and transmits many popular gramophone records, many of which are never normally heard through our own broadcast stations, and, as the quality is very good, it is of real entertainment value.

AUSTRALIA.—Our own National short-wave station will be appreciated even more now by our outback listeners who are unable to hear the news, etc., from the broadcast band stations. In addition to VLR there are also the experimental stations, 2ME, 3ME, and 6ME, which are heard very well in certain locations.

RAY SIMPSON'S PAGES

The MONTH on SHORT WAVES

WAR NEWS FROM EUROPE AND AMERICA

HIGHER FREQUENCIES IMPROVE

Since our last issue, events in Europe have moved with dramatic suddenness, plunging Europe into war again. It is too early yet to forecast what the effect may be on short-wave listening, but we should be very surprised if there is any discontinuance of short-wave broadcasts from the nations involved.

We have already read that the German Government has prohibited its citizens listening to short-wave broadcasts from foreign stations, but we do not anticipate any such prohibition in the British Empire.

It is true that during the last war the Commonwealth Government confiscated all receivers, but radio was in its infancy then, while now it is a national outlet, by which means the Government may keep the people informed of the war position, and actions to be taken for the defence of the country.

NO COMMENT!

In these notes it is not our desire or intention to pass any comment on what may be heard from the various stations, but merely to mention the stations that are now audible, leaving listeners to form their own conclusions on the actual matter broadcast.

A word of warning may not be amiss here, as to the divulgence of any information which may be heard, and which if repeated may be of value to an enemy country. So, keep your own counsel, and thereby, we hope, ensure the continuance of the privileges we still enjoy.

As readers will realise, many changes will undoubtedly take place at short notice, which may make some of the information we publish out of date before it is actually in print, but by their own listening readers will be able to keep themselves informed of any alterations which may take place.

CONDITIONS IN S.A.

During the last two or three weeks we were able to check conditions in South Australia, being resident in Adelaide at the time. Generally speaking, conditions are very similar to those obtaining in the Eastern States, the same stations being heard at approximately the same signal strength.

An improvement which appears general is that of the 16 and 19 metre stations, which are being heard at much better strength than a few months ago. Also in some locations the higher frequency stations on the 13 metre band are now coming in at quite fair level.

Twenty-five metres has again been very disappointing, though on a few occasions good reception has been possible, notably the U.S.A. stations during the late afternons, with special transmissions.

We again wish to thank the many listeners who forwarded us reports for this issue, enabling us to cover many stations which might otherwise have been omitted due to our absence from our regular receiving location. In due course we hope to reply personally to them all, but in the meantime we would like you to know how much we appreciated your co-operation.

Will readers please send all reports for the next issue in time to reach us by Monday, October 2, in order to ensure being acknowledged in the November issue.

EMPIRE STATION SCHEDULES

Just as we go to press, we learn of extensive changes in the times of operation of the various Empire transmitters, which are briefly as follow:—

Trans. 1: Over GSI, GSP, GSD, GSW GSB, and GSE from 3.57 p.m. til 8 p.m.
Trans. 2: From 8.45 p.m. till 3 a.m.
Trans. 4A: From 3.17 a.m. till 6.1[illegible] a.m.
Trans. 4B: From 6.30 a.m. till 9 a.m.
Trans 5: From 9.22 a.m. till 12.15 p.m
Trans. 6: From 12.37 p.m. till 3.3[illegible] p.m. GST—21.550kc., 13.92 metres
Trans. 2, 8.45 p.m. till 3 a.m.

All times shown above are Eastern Australian Standard Time. We would advise listeners, however, to watch for any further changes which may take place.

SWISS STATION DESTROYED

Here is the Short-Wave Transmitter, recently built by the Swiss Government which was completely destroyed by fire before operations were commenced. Rebuilding was in hand the day after the fire. Little will be changed, apart from the incorporation of any new developments which may have taken place since the first transmitter was designed. Note the shadow of an aerial mast in the foreground. There appear to be nine such masts in the aerial system.

SHORT-WAVES

BROADCASTS from BALKANS

NEW TRANSMITTERS IN BULGARIA AND YUGOSLAVIA

There are not a great number of short-wave stations in the Balkan States, but these have now been supplemented by two new transmitters, one in Bulgaria, and the other in Yugoslavia.

OF the two, the better has been LZA, in Sofia, Bulgaria, which has been on the air every morning till closing down at 7.30. The frequency used is 8500kc., 35.29m., which is off the regular broadcast bands, but well in the clear so easily found. Usually an announcement is given at 6.45 a.m. by a lady, then quite often there is a recorded session without any announcements till they close down at 7.30 a.m. with what we take to be their National Anthem.

As mentioned in the July issue, the Yugoslavian authorities were building another short-wave station at Zenum, and would shortly be testing in the various regular bands. What appears to be one of these new stations has been heard recently on 9500kc., 31 58m., during the early morning hours.

At our location this station has not been very strong, but its identity was easily established. An English news session is broadcast every morning at 7.40, when events of international importance are given. As the 7200kc. to 7300kc band is now open for European broadcasters, they will probably soon be using a frequency in this channel, and will quite likely be heard at good strength, if one can judge by the French and Portuguese stations on the same band. We believe the call letters of the 9500 kc. station to be YUC.

"LISTEN-IN ON TOKYO!"

The Hoso-Kaikan, new headquarters of the Broadcasting Corporation of Japan, costing over 4,000,000 yen, was opened last May, fully equipped with up-to-date scientific facilities.

NEW "PARIS MONDIAL" STATION

THE French authorities are at present testing a new transmitter on 30.99m., according to our correspondent, Mr. Hallett, when they come in at quite good strength till closing down at 3.45 p.m. This is probably another of the new transmitters which they recently announced as shortly to take the air.

LATVIA BROADCASTS

Special DX broadcasts from YL2CD, on 14,040kc., are to be carried out on September 10, 17, and 24 at 3 p.m. E.A.S.T., and also in November on the 12th and 19th at 1 a.m. E.A.S.T. The latter two transmissions will be on 28,080kc.

FLASHES FROM EVERYWHERE

ARGENTINA

It would appear from advice just received from the Argentine radio authorities that the station was reported last month on 17,830kc. as LRA1 is actually LRA5. In addition to this transmitter they also have another one, LRA2, on 6180kc. 48.54m., which operates from 9.30 a.m. daily. These are, of course, in addition to the well-known LRA1 on 9690kc. 30.96m.

DENMARK

The Danish State Broadcasting Service advise that their OZH2 transmitter carries out experimental broadcasts every Sunday from 11 p.m. till 4.30 a.m. Mondays, and also on holidays at the same time. OZF, on 9520kc. 31.51m., is on the air daily from 11 a.m. till 12.30 p.m. with directional aerial to South America and the Far East, and from 12.30 p.m. till 2 p.m. with aerial directed on North America and Greenland. They use a power of 6kw.

NORWAY

From the State broadcasting authorities in Norway we are advised that LLG, on 9610kc. 31.22m., is no longer in use, and that the present operating time of LKQ, 11.735kc. 25.57m., is from 9 a.m. till 9.40 p.m., and through LKV, 15,170kc. 19.78m., from 9.40 p.m. till 9 a.m. The power of these stations is 5kw.

GUADELOUPE

The French West Indian station FG8AA, in Point-a-Pitre, which now operates on 7440kc. 40.32m., uses the march "March Lorraine" as an identification signal. Listeners who are not acquainted with this march are recommended to listen to "Philco Radio" in Saigon, who also use the same one as their opening number.

PORTUGAL

We learn from the official list published in Berne that the following are the calls and operating times of the Portuguese national stations:—

CSW4: 15,215kc., 19.71m. 10 p.m. till midnight, to Macao, Timor, and India. 3 a.m. till 4.30 a.m., to Angola, Mozambique, Guinea, S. Thome, Cape Verde, and adjacent islands.

CSW6: 11,040kc., 27.17m. 4.45 a.m. till 7.50, to same places.

CSW7: 9740kc., 30.80m. 9.13 a.m. till 10 a.m., to South America; 10.5 a.m. till noon, to North America.

CSW8: 7260kc., 41.32m. 8.5 a.m. till 9 a.m., to Europe.

From our own observations, these times do not appear to be strictly adhered to; also, CSW4 is definitely not on 15,215kc., but on 15,120kc.

URUGUAY

We are advised by the Sodre, which is the official broadcasting service of Uruguay, that they now also have two new transmitters on the air—namely, CXA10, on 11.895kc. 25.22m., and CXA18, on 15,300kc. 19.61m.

REPORTS FROM READERS

Letters from our readers containing short-wave reports continue to arrive at our office. These letters are a valuable aid in checking our own lists, and they also provide interesting reading for other enthusiasts. Here are some brief acknowledgements.

Mr. H. R. Cox (Cobden, New Zealand): This month we welcome our first overseas correspondent to send us a report, and, judging by his letter, conditions are very similar to our own, all the popular stations being well heard. The station on 15,400kc. which you are hearing is almost certainly RV96, Moscow, one of the many U.S.S.R. stations, which also come in here at good strength. Looking forward to further reports from you, Mr. Cox.

Mr. R. K. Clack (Chester Hill, N.S.W.): Mr. Clack's report unfortunately did not reach us in time for inclusion in last month's issue, but it was none the less welcome, and, with a further report, has been included in this issue. Many thanks for your co-operation in sending your notes at such short notice.

Mr. J. H. Ford (Rockhampton, Qld.): Once again Mr. Ford gives us all the news from his district, and, considering the fact that he is moving around most of the time, it speaks volumes for his enthusiasm that he is able to hear as much as he does. We have replied to you by mail, which you will have received before this.

K. Mc. (North Fitzroy, Vic.): Our Melbourne Correspondent has again been very active in his loggings, as shown by the Listen for These columns. Looking forward to hearing from you again.

Mr. A. Lee (Dubbo, N.S.W.): Found that conditions were very poor for a period of nearly four weeks, but has now improved, as may be seen from his loggings. He has recently received verifications from W6XBE, TAP, HBO, and 2RO9, which, added to all his others, must now make a very imposing display. Many thanks for forwarding your report at such short notice.

Mr. L. J. Keast (Randwick, N.S.W.): Mr. Keast makes mention of the great improvement in the 16 and 19 metre bands at night, and is looking forward to summer conditions. He heard quite a number of the American stations giving their news flashes on the international situation. He also mentions a mystery station which we have included in the panel.

Mr. E. J. Risely (Brighton, South Aust.): During our stay in Adelaide, Mr. Risely kindly gave us the use of his aerial in order that we might keep abreast of the times, and some excellent reception was obtained at his location, which is right on the sea-front and free from all interference, which was not the case while listening in the city area.

Mr. P. G. Emery (Bathurst, N.S.W.) sends us a very well-laid-out report of his reception during the last few weeks, also two snapshots of his shack, which are very interesting. We will certainly consider your suggestion re the forming of a Listeners' League, though personally we think there are enough of them at present. Thank you for your subscription to R. & H., which we have passed on to our circulation department. Will be writing you within a few days, probably before this is in print.

Mr. Roy Hallett (Enfield, N.S.W.) is another new contributor whom we are very pleased to hear from, as he sends some interesting information, chief of which was he heard "Radio Luxembourg" testing on 25.46m. at 4 a.m. one morning, and he also advises that KGEI now also operates in the 49-metre band between 3 and 6 p.m. This up-to-the-minute news was greatly appreciated, Mr. Hallett, and we hope to hear from you again.

Mr. B. W. Battis (Coraki, N.S.W.). Mr. Battis has been doing some very good listening lately, and forwards a good list of his loggings. He is hearing a station between CSW8 and TPB11 which closes at 7.15 a.m. Can anyone help to identify this one? Practically all the well-known stations are coming in well in his district.

Mr. C. C. Allen (Mataura, New Zealand) is another New Zealand listener who reads "Radio and Hobbies" regularly, and uses a simple two-valve set for his listening, and which gives him very good results. The station you heard was W6XBE, on Treasure Island, San Francisco (call letters recently changed to KGEI), which operates on 9530kc., 31.48m., and has been mentioned frequently in past issues. The above address will find them.

Mr. H. Medina (Waverton, N.S.W.) is another new correspondent who contributes an extensive list of loggings, as shown in the station list. He has been hearing not only the usual stations, but quite a lot of the more elusive ones, and supplied quite an amount of interesting data. Many thanks, Mr. Medina, and hoping to hear from you again.

Mr. H. L. Semmler (Greenock, South Australia) sends us his first report, covering his short-wave listening during the past few weeks. Mr. Semmler uses a simple three-valve receiver, detector and two audio, with 4-volt valves. He finds this ideal for general reception. Would like to hear from you again, as we are interested in reception in your State, having been there during the past month.

U.S.A. STATIONS ACTIVE

One of the incidental effects of the tense European crisis has been the opportunity it has given short-wave listeners to hear some of the United States stations on frequencies not generally audible in this country.

It is indeed a very disturbing thought that it should be by such a serious occasion we have been able to tune in these stations.

While the various Powers were exchanging views in an effort to avert war, the various networks in the U.S.A. remained on the air long after their normal closing hours, giving news flashes and dramatised versions of the situation as it appeared to them. Compared to the restrained news bulletins from Daventry, and the inspired news sessions from some of the European countries, the American versions were probably quite unbiased, but, due to the way they were presented, made one wonder if the gravity of the position was fully realised by those responsible. The most concise and impartial news service from the U.S.A. is undoubtedly that from KGEI, on Treasure Island, which is heard nightly at 10.30, giving the latest news from all parts of the world. Those listeners who remain up after midnight can also hear the second news bulletin from this station, which is given at 12.30 a.m.

TEST TRANSMISSIONS FROM AMERICA

NEW BEAM ANTENNA TO BE EMPLOYED

DURING the month of September the World Wide Broadcasting Foundation stations, W1XAL and W1XAR, will be carrying out test transmissions on their various frequencies, and would greatly appreciate reports from this country.

Their stations were closed down between about July 21 till around August 25 to enable them to instal additional equipment and new beam antennae, which should result in improved reception in many parts of the world. Their power will then be 20,000 watts, and their beams directed on Europe, North and Central America and West Indies, and also a Latin American beam. Their various frequencies are 6040kc., 49.67m., 11.730kc., 25.58m., 11.790kc., 25.45m., 15.130kc., 19.83m., 15.250kc., 19.67m., and 21,460kc., 13.98m.

Listen for these!

OVERSEAS STATIONS NOW AUDIBLE

Here is a list of short-wave stations which have actually been heard over the last few weeks. Most of these should be heard by any of our short-wave fans who have a good set and location. Details of each station are given, and when also reported by readers, their names appear in brackets.

ENGLAND

GSA.—6050kc., 45.59m. Still being heard on this band every morning, but not as strong as before. (Ford.)

GSB.—9510kc., 31.55m. This transmitter is still coming in very well in the afternoons. (Lee, K. Mc., Cox, Ford, Foster, Medina, Semmler, Emery.)

GSC.—9580kc., 31.32m. This one is used in the mornings and has quite a good signal usually. (Lee, Foster, Cox, Semmler.)

GSD.—11,750kc., 25.53m. In the afternoons, in transmission No. 1, this one is really good entertainment level. (K. Mc., Ford, Foster, Lee, Cox, Medina, Emery, Semmler.)

GSF.—15,140kc., 19.82m. Heard in the early mornings, and also now becoming quite good at night from 10 p.m. (Foster, Clack, Lee, Ford, K. Mc., Medina, Battis.)

GSG.—17,790kc., 16.86m. Now being heard at much better level at night. (Lee, Ford, Emery, Foster, Keast.)

GSI.—15,260kc., 19.66m. Still being heard very well in the afternoons in the No. 1 transmission. (Lee, K. Mc., Cox, Medina, Semmler, Emery.)

GSJ.—21,530kc., 13.93m. The 13-metre stations are now beginning to come in again at fair level. (Lee.)

GSO.—15,180kc., 19.76m. Still being heard quite well in the forenoons with their South American transmission. (K. Mc., Cox, Lee, Foster, Medina.)

GSV.—17,810kc., 16.85m. Another of the 16-metre stations which are now improving nightly. (Lee, Foster, Keast, Emery, Battis.)

GRX.—9690kc., 30.96m. This is a morning station and comes in at quite good strength. (Lee, Ford, Medina, Emery.)

GSP.—15,310kc., 19.6m. This transmitter again in use in mornings at 7.30 a.m. at good strength. (Medina, Lee.)

GSW.—7230kc., 41.49m. Heard this new transmitter for the first time on September 3, but was very weak at our location.

GSE.—11,860kc., 25.29m. Heard very weakly in the afternoons at 4 p.m. (Emery.)

AUSTRALIA AND OCEANIA

VK2ME.—9590kc., 31.28m., Sydney. At our location this one is terrific strength and is also heard well in other places on Sundays. (Cox, Ford, Foster, K. Mc., Emery, Lee, Semmler, Medina.)

VK3ME.—9500kc., 31.5m., Melbourne. The Melbourne experimental station can be heard nightly, but interfered with slightly by KZIB. (Cox, Foster, Lee, Emery, Semmler.)

VK6ME.—9590kc., 31.28m., Perth. On most nights is fair strength, but on others it is inaudible. (Ford, Cox, Lee, Clack, Medina, Semmler, Emery.)

VLR.—9580kc., 31.32m., Lyndhurst. The National station puts in an excellent signal in the daylight hours. (Cox, Ford, Foster, Lee, Clack, Medina, Emery, Semmler.)

VK9MI.—6052kc., 49.57m., M.V. Kanimbla. The cheery voice of Miss Foley can be heard from this ship station around 10 p.m. (Ford, Cox, Clack, K. Mc., Emery.)

ZMBJ.—8840kc., 33.94m., R.M.S. Awatea. Now only heard in telephone traffic with Sydney and New Zealand. (Cox.)

VPD2.—9538kc., 31.38m., Suva, Fiji. Still comes in at very good strength till closing at 10 p.m. (Cox, Ford, Foster, Lee, Clack, K. Mc., Medina, Battis.)

FK8AA.—6122kc., 49.00m., Noumea, New Caledonia. Only heard on Wednesdays and Saturdays from 5.30 p.m. till 6.30 p.m. (Cox, Ford, Clack, Battis.)

VLR3.—11,880kc., 25.25m., Lyndhurst. The National short-wave station has now changed to the 25-metre band in daylight. (Lee, Emery, Battis.)

FRANCE

TPA2.—15,245kc., 19.68m., Paris. Still rather weak, but can be copied round 10 p.m. (Keast, Cox, Lee.)

TPA3.—11,885kc., 25.23m. Heard at quite good strength around 4 p.m. (Cox, K. Mc., Medina.)

TPA4.—11,720kc., 25.6m. Quite good strength till they close down in the afternoon. English news session at 2 p.m. (Cox, Foster, Clack, Medina.)

TPB3.—17,850kc., 16.81m. On some nights we have heard this 16-metre French station at very good strength.

TPB7.—11,885kc., 25.23m. This one is heard in the afternoons and also gives news in English at 2 p.m. (Cox, Foster, Medina, Emery.)

TPB6.—15,130kc., 19.83m. This one comes in very well after 4 p.m. (Foster, Lee.)

TPB11.—7280kc., 41.21m. One of the loudest stations on the air in the early mornings at 7 a.m. (Cox, Clack, Foster, Medina, Emery.)

TYA2.—9037kc., 33.19m. This French station now seems to have a regular session in the afternoons around 5 p.m. (Emery.)

ITALY

2RO3.—9635kc., 31.13m., Rome, Italy. Some excellent programmes are heard from this station in the mornings. (Cox, Ford, Foster, Lee, Clack, Medina, Battis, Hallett.) Special transmissions Sunday, 4 p.m. to 5 p.m., to Australia and New Zealand.

2RO6.—15,300kc., 19.61m. Heard in the mornings at about 8.30 a.m. (Cox, Ford, Clack.) Also in evening till about 7.30 p.m.

2RO8.—17,820kc., 16.84m. Heard best between 9 and 10 a.m., but can also now again be heard around 11 p.m. (Ford, Emery.)

2RO9.—9667kc., 31.03m. Another morning station, but not as loud as 2RO3. (Ford, Medina, Lee, Foster.)

IRF.—9830kc., 30.52m. This transmitter is used in the early mornings at 4 a.m. and also for special transmissions.

2RO4.—11,810kc., 25.4m. This Italian is good strength at 1 a.m. (Keast.)

2RO12.—15,100kc., 19.87m. On some occasions this one is heard at quite fair strength. (Battis.)

THIS MONTH'S VERIFICATIONS

FINE CARD FROM CUBA

COJK, 8685kc., 34.54m., Camaguey, Cuba. The verification card from this station is one of the best we have seen, being a double folder, with their broadcast call, CMJK, on the one side, and COJK on the other. The letters of the call are filled in with views of the city and surrounding beauty spots. Their address is Finlay Numero 3, Altos, Camaguey, Cuba.

OZH2, 15,320kc., 19.58m., Skamlebaek, Denmark. The Danish State broadcasting service sends out a very plain card verifying our reception of their 19-metre station. Certainly brief, but quite acceptable.

LLG, 9610kc., 31.22m., Oslo, Norway. The Norwegian authorities now send out quite an attractive card verifying reports, showing the call letters in red of the station concerned and also the calls and operating times of some of their other transmitters. Address is: Administration of Telegraphs, Radio Department, Broadcast Division, Oslo, Norway.

WQXO, 31,500kc., 9.5m., Juneau, Wis., U.S. From Mr. Erwin Beneditz, the chief radio operator of this police radio station, we received a very nice letter verifying our report of last June. They use a vertical "J" type antenna with 100 watts power. Our report was their first received from Australia, and also was the first they had received from any country outside the U.S.A. An interesting poin was the fact that the car they we chasing when we heard them w eventually overtaken and the driv arrested for having an out-of-da licence.

W1XAR, 11,730kc., 25.58m., Bosto Mass., forwarded a very pleasant le ter, also verification card, giving de tails of their station. In their lett they say: "Yours is the first repo from Australia on our W1XAR, an when we received it we were quite ex cited, because a 'first' is always a event." They are very anxious fo reports from any other of their lis teners in Australia who may hea them.

OZF, 9520kc., 31.51m., Skamlebaek, Den mark. This Danish station has veri fied our report of a few months ag using their plain black and whit card. Their address is Statsradio fonien, Heibergsgade 7, Copenhage Denmark.

LKQ.—11,735kc., 25.57m., Oslo, Norway Sent a similar card to that receive for LLG, but of course with the let ters LKQ shown instead.

CXA6, 9620kc., 31.18m., Montevideo Uruguay. The Official Broadcastin Service of Uruguay sent a very at tractive card verifying our reception of CXA6. The card is printed in sil ver and blue, and gives details of thei various schedules.

MISCELLANEOUS

PCJ2.—15,220kc., 19.71m., Huizen, Holland. Now being heard very well on a Tuesday afternoon in their special transmission at 4 p.m. (Cox, Ford, Foster, Medina, Emery.)

HBO.—11,402kc., 26.32m., Geneva, Switzerland. Comes in very well between 4.30 p.m. and 5.15 p.m. (Ford, Cox, Emery.)

HBL.—14.535kc., 20.64m., same location. Heard at the same time as HBO, and also at good strength. (Ford, Cox.)

CZF.—9520kc., 31.51m., Skamlebaek, Denmark. Now putting in quite a good signal from about 1.30 p.m. till 2 p.m.

SP19.—15,120kc., 19.84m., Warsaw, Poland. Can still be heard in the mornings, opening at 9 a.m. (Cox, Medina.)

SP48.—6140kc., 48.86m., same location. Heard opening at 6 a.m., but not very strong; lady announces in English.

CS2WD.—5977kc., 50.2m., Lisbon, Portugal. Still being heard in the mornings at 7 a.m. with fair signal.

CSW7.—9740kc., 30.8m., same location. Puts in a very good signal in the mornings just before 9 a.m.

CSW8.—7260kc., 41.32m., same location. One of the best stations on the 41-metre band and heard every morning till 8 a.m. (Ford, Clack, Foster, Lee, Medina.)

YUA.—6100kc., 49.18m., Belgrade, Yugoslavia. Another 49-metre band station heard in the mornings around 7 a.m. (Medina.)

EAQ.—9860kc., 30.44m., Madrid, Spain. In the early mornings can be heard at good level. (Foster.)

LKJ2.—6130kc., 48.94m., Oslo, Norway. Heard in the early part of August at fair strength, but not now audible at our location.

LKV.—15,170kc., 19.78m., same location. Comes in very well in the mornings, just before 7 a.m.

OIE.—15,190kc., 19.75m., Lahti, Finland. This Finnish station can still be heard when not blotted out by GSO.

OFD.—9500kc., 31.58m., same location. Heard at the same time as OIE and at much better strength.

TAP.—9465kc., 31.7m., Ankara, Turkey. Very strong in the mornings till they close at 8 a.m. (Ford, Foster, Lee, K. Mc., Medina, Cox.)

TAQ.—15,195kc., 19.74m., same location. On several occasions this other Turkish transmitter has been heard till just after 10 p.m.

ORK.—10,330kc., 29.04m., Ruysselede, Belgium. Never a very strong station, but can be heard in the early morning until 6 a.m. (Foster.)

CLR5A.—15,230kc., 19.7m., Prague, Bohemia. Another station which varies in strength from day to day, but usually very fair on closing at 1 p.m. (Emery.)

ZAA.—6085kc., 49 3m., Tirana, Albania, Not on regularly, but when on the air are heard at quite good level.

LYR.—9280kc., 32.33m., Kaunas, Lithuania. Only heard on two occasions, and at both times closed abruptly without any announcement, and station went over to telegraphic office.

CSW6.—11,040kc., 27.17m., Lisbon, Portugal. Comes in quite well at 6.30 a.m. (Foster, Clack.)

OZH2.—15,320kc., 19.58m., Skamlebaek, Denmark. Putting in a very nice signal around 11.30 p.m. (Keast, Medina.)

YUC.—9500kc., 31.58m., Belgrade, Yugoslavia. This is the new transmitter which has recently opened on this band, much better than the one on 49 metres. (K. Mc., Hallett, Lee.)

PCJ.—9590kc., 31.28m., Huizen, Holland. Mr. Emery reports this one at R7 at 11 p.m.

U.S.S.R.

RNE.—12.000kc., 25.0m., Moscow. This powerful Russian is very loud in the morning from 7 a.m. (K. Mc., Clack, Foster, Ford, Cox, Medina, Emery, Battis.)

RKI.—15,083kc., 19.89m. Heard at very good strength at 5 p.m. with news session, and also in the forenoons till noon. (K. Mc.)

RAL.—9600kc., 31.25m. On the air on some days at 7 a.m., but not regularly.

RIM.—15,252kc., 19.67m., Tashkent, U.S.S.R. Heard nearly every night now, but mostly with telephone traffic. (K. Mc.)

RV96.—15,400kc., 19.49m., Moscow. This one is heard quite often around 8 p.m. and also later at night.

RV96.—15,180kc., 19.76m. In the afternoons this station can be tuned at very good level. (K. Mc., Cox, Foster Ford, Medina.)

RV96.—9520kc., 31.51m. Still being heard with a very loud signal in the early mornings. (K. Mc., Foster, Medina.)

RV96.—6030kc., 49.75m. This station was very loud one Sunday morning at 8 a.m., when English news session is given. (Medina.)

RV96.—7365kc., 40.76m. This station was also giving the news in English, and the announcer stated that it would be given every Sunday at 8 a.m. over stations on 25, 31.51, 40.76, and 49.75 metres.

SWEDEN

SBP.—11.705kc., 25.63m., Motala, Sweden. Still being heard with a very good signal till around 7.15 a.m., when they close with English announcement. (Emery.)

SBT.—15,155kc., 19.79m., same location. Can still be heard at same time as SBP, but not as strong; best in session opening at 11 a.m. on Thursdays and Sundays. (Medina, Battis.)

SBO.—6060kc., 49.5m., same location. Opens at 7.15 a.m. at good strength, but soon fades out.

MYSTERY STATIONS

THIS month we are unfortunately unable to remove any of our mystery stations from last month's panel, as we have been unable to obtain any further information either from our own listening, or from our correspondents' reports, so they will have to remain unidentified, together with those of previous months. Further stations not yet definitely identified are shown below.

9,850kc. 30.35m. Station with French announcement heard at 1.0 a.m. (Keast).

9,500kc. 31.58m. Heard in morning from 7.0 a.m. onwards (Lee). (This may be the new Yugoslavian or OFD).

14,010kc. 21.41m. Spanish speaking station, heard between 2.0 p.m. and 2.45 p.m. (Clack). (Suggest may be YN3DG on 13,900kc.).

8,000kc. 37.5m. Heard between 8.30 p.m. and 10.0 p.m., very harsh (Ford).

As mentioned before we shall always be pleased to receive any further information on these or other stations in this panel published in previous issues.

NORTH AMERICA

KGEI.—9530kc., 48m., Treasure Island. Still coming in nicely in afternoon and night sessions. (Cox, Clack, K. Mc., Ford, Foster, Lee, Keast, Semmler, Medina, Emery, Battis.)

KGEI.—15,330kc., 19.57m. Same location. This Treasure Island transmitter is heard until closing at 2.15 p.m. (Ford, Foster, Keast, Cox, Emery.)

WLWO.—6060kc., 49.5m., Cincinnati, Ohio. Much weaker on opening at 8.45 p.m., though good in late afternoon. (Cox, Ford, Foster, Medina, Hallett.)

WGEA.—9550kc., 31.41m., Schenectady, N.Y. Heard in the mornings and also in their special transmissions in the late afternoon till 6 p.m.

WGEO.—9530kc., 31.48m. Same location. Heard at good strength till 8 a.m. and also at lunch time on some occasions.

WPIT.—11,870kc., 25.27m., Pittsburg, Pa. Heard weakly in the early morning, but better at 2 p.m. and occasionally later. Notice corrected call letters given in error last month as WTIP. (Ford, Foster, Keast, Medina, Battis.)

WPIT.—15,210kc., 19.72, same location. This one opens at midnight and is sometimes quite good. (Emery, Keast.)

WBOS.—9570kc., 31.35m., Boston, Mass. Heard at excellent strength in the afternoons with war news, &c. This was formerly WIXK. (K. Mc., Emery.)

WRCA.—9670kc., 31.03m., New York, N.Y. Another American station heard at very good level in late afternoon. Formerly W3XAL. (Cox, Keast, Clack, Hallett.)

WNEI.—17,780kc., 16.87m., same location. This one heard at quite good strength till noon. Formerly W3XL, not quite positive of new call letters. (Foster, Lee, Hallett, Cox.)

KKZ.—13,690kc., 21.91m., Bolinas, Cal. This point to point RCA transmitter relays the Columbia Broadcasting System programme to Hawaii on Sunday afternoons till 2.45 p.m. (Ford, Foster, Keast.)

W1XAL.—11,790kc., 25.45m., Boston, Mass. This Boston station has been heard at good strength around 7.30 a.m.

W1XAL.—15,250kc., 19.67m., same location. Mr. Keast has heard this one at good level around midnight.

W2XE.—11,830kc., 25.36m., New York, N.Y. On many afternoons this New York station was particularly good in the afternoons. Foster, K. Mc., Clack, Emery, Hallett.)

W2XE.—6120kc., 49.02m., same location. Also heard with special programmes and war bulletins in the late afternoons. (Foster, Lee, Clack.)

W2XE.—9650kc., 31.09m., same location. This 31 metre channel was also used on occasions for news of the war, &c. (Foster.)

W2XE.—17,830kc., 16.83m., same location. The 16-metre transmissions from W2XE have been heard weakly at 10 p.m. (Cox, Lee, Emery.)

W2XE.—15,270kc., 19.64m., same location. Still another frequency used by this station, and heard well at 1 a.m. (Keast, Lee.)

WGEA.—15,330kc., 19.57m., Schenectady, N.Y. This station has also been heard at quite good strength at 7 a.m. (Emery, Keast.)

W3XAU.—9590kc., 31.28m., Philadelphia, Pa. Another American station heard in the afternoons. New call is WCAV or WCAB, but will list under old call until we are certain of letters. (Emery, Hallett.)

XEXA.—6175kc., 48.58m., Mexico City, Mexico. Still being heard at night with their physical exercises, but not very strong.

XEWW.—9500kc., 31.5m., same location. Heard in the afternoons and also around 11 p.m., when they are quite good. (Cox, Foster, K. Mc., Emery.)

XEUZ.—6117kc., 49.04m., Mexico City, Mexico. Has been heard on Sunday afternoons till 5 p.m. (Emery.)

SOUTH AMERICA

LRX.—9660kc., 31.06m., Buenos Aires, Argentina. Listen for this one till closing with their distinctive waltz at 2.30 p.m.

LRA1.—9690kc., 30.96m., same location. Still being heard on a Saturday morning at 7 a.m.

LRA5.—17,830kc., 16.83m., same location. Only heard once since last month, and also on a Saturday morning at 7.30 a.m.

OAX4J.—9340kc., 32.12m., Lima, Peru. Still one of the best Sunday afternoon stations till closing at 4 p.m. (Foster.)

OAX5C.—9350kc., 31.95m., Ica, Peru. Only heard on Sunday afternoons till they close with English announcement at 3 p.m.

OAX4T.—9566kc., 31.38m., Lima, Peru. On some nights this one is excellent strength when they open at 11 p.m.

CXA2.—9570kc., 31.35m., Montevideo, Uruguay. On some forenoons this South American can be heard at excellent strength.

CXA6.—9620kc., 31.19m., same location. Now very much weaker in the mornings and is best at about 7 a.m.

CXA8.—9640kc., 31.12m., same location. Occasionally heard late at night, but comes in best on Sunday afternoons till 4 p.m. or 5 p.m.

CB960.—9600kc., 31.25m., Santiago, Chile. Can still be heard in the mornings till they close down at 7.30 a.m., and also on some nights after 10 p.m.

CB1170.—11,700kc., 25.64m., same location. Only heard in the afternoons till they close down at 2 p.m.

CD1190.—11,910kc., 25.19m., Valdivia, Chile. On some Sundays has been heard at very good strength from around noon till they close at 2 p.m.

PRA8.—6015kc., 49.87m., Pernambuco, Brazil. Only heard in the mornings when they open at 7 a.m., with clock striking, and now very weak.

ZP14.—11,730kc., 25.58m., Villarica, Paraguay. Heard quite often now in the early forenoon between 9 a.m. and 10 a.m.

HCJB.—12,460kc., 24.08m., Quito, Ecuador. This South American can still be heard, but very weak compared to formerly. (Foster, Cox, Clack, Ford.)

HJAG.—4905kc., 61.16m., Colombia. Another Sunday afternoon station heard on their new frequency by Mr. Emery.

NORWEGIAN CALLS AND FREQUENCIES

THE following are the various calls and frequencies of the Norwegian short-wave stations located at Oslo and Jeloy.

LKJ2—6,130kc. 48.94m.
LCL—8,025kc. 37.39m.
LKC—9,530kc. 31.48m.
LKE—9,572kc. 31.34m.
LLG—9,610kc. 31.22m.
LCN—10,715kc. 27.99m.
LKQ—11,735kc. 25.57m.
LKU—11,830kc. 25.36m.
LKV—15,170kc. 19.78m.
LKX—15,175kc. 19.77m.
LKW—17,755kc. 16.99m.
LKY—21,450kc. 13.98m.
LKZ—21,500kc. 13.95m.

CENTRAL AMERICA AND WEST INDIES

TGWA.—9685kc., 30.98m., Guatemala City, Guatemala. Now is quite a popular station with their DX sessions and marimba orchestra selections. (Cox, Ford, Foster, Emery, Medina, Clack, Lee.)

TGWB.—6490kc., 46.19m., same location. Not heard as well as the one on the 31-metre band, but can be easily identified. (Cox, Foster, Emery.)

TG2.—6190kc., 48.47m., same location. Another Guatemala station only heard on Sunday afternoons usually. (Cox.)

TIPG.—9620kc., 31.19m., San Jose, Costa Rica. Now being heard very well every night on opening at 10 p.m., and also can be copied in the mornings at 8.30 a.m., when they are also strong. (K. Mc., Medina, Semmler, Battis.)

TILS.—6165kc., 48.66m., same location. Now a regular night station on the crowded 49-metre band. Best on opening at 10 p.m. with "Stars and Stripes." (K. Mc., Hallett.)

MP5K.—6005kc., 49.95m., Panama City, Panama. Here is another well-known station also opening at 10 p.m., and also has frequent English announcements.

HP5J.—9590kc., 31.28m., same location. Again being heard after 10 p.m. with quite a good signal.

COGF.—11,805kc., 25.41m., Matanzas, Cuba. Heard at fair strength at night from about 9.30 p.m. (Medina.)

COJK.—8685kc., 34.54m., Camaguey, Cuba. This is now the strongest of the Cubans, and is heard nightly from 9.55 p.m. rebroadcasting COCO and CMCK.

COCQ.—We can still give no definite frequency to this one, but it is always around the 34-metre mark. Not heard very well of late.

COBC.—9985kc., 30.05m., Havana, Cuba. "El Progreso Cubano" comes in quite well on most nights from just before 10 p.m.

COCM.—9850kc., 30.46m., same location. Another Cuban which is usually audible after 11 p.m. (Emery.)

Radio Martinique.—9705kc., 30.92m. What appeared to be this station was heard by Mr. Medina giving news in English till closing with "Marseillaise" at 2.25 p.m.

INDIA AND ASIA

KZIB.—9500kc., 31.58m., Manila, Philippine Islands. A very good signal is heard from this one nightly. (Ford, Foster, Lee, Clack, K. Mc., Semmler.)

KZIB.—6040kc., 49.67m., same location. On the air at same time as the 31.58m. station, but interfered with by YDD. (Clack, Foster, Lee, K. Mc., Medina, Battis, Hallett, Emery.)

KZRM.—9570kc., 31.35m., same location. A very loud station, with some very good programme items. (Ford, Clack, Cox, Foster, Medina, Semmler, Emery, Battis.)

KZRM.—6140kc., 48.86m., same location. A fairly loud signal, but suffers from the noise level. (Ford, Clack, Cox, Emery, Hallett, Battis.)

STATION ADDRESSES

AS promised in last month's issue, we give below a few station addresses which may be useful to readers in writing for verifications.

ZP14: Radiodifusora ZP14, "Radio Cultura," "La Vox del Corozon," Friedmann Hnos, Villarica, Paraguay, South America.

LRA1-LRA5: Direccion General de Correos y Telegraphos, Estacion de Radiofusion del Estado, Buenos Aires, Argentine Republic.

XEYU: "Radio Universidad Nacional," Servicio de Radiodifusion, Calle de Justo Sierra 16, Mexico, D.F.

TIPG: Radiodifusora TIPG, "La Vox de la Victor," Apartado 225, San Jose, Costa Rica, Central America.

KZEG.—6140kc., 48.86m., same location. This station often heard on the same frequency. (Ford, Clack, Keast, K. Mc., Medina, Emery, Hallett.)

KZRH.—6110kc., 49.1m., same location. Only a very fair signal, as they are very near the powerful Saigon transmitter. (Foster, Lee, Clack, Keast, Medina, Hallett.)

KZRF.—6140kc., 48.86m., Manila. This station, "Radio Philipino," is occasionally heard on this frequency. (Clack, Lee, Battis.)

ZHP.—9690kc., 30.96m., Singapore, S.S. Can be heard nightly with very good signal, also rebroadcasts London. (Ford, Clack, Foster, Medina, Semmler, Emery, Battis.)

ZHJ.—6080kc., 49.3m., Penang, S.S. Still being heard very well nightly with recorded music. Lady and gent. announcer. (Clack, Ford, Foster, Lee, Medina, Battis, Hallett.)

HS8PJ.—9510kc., 31.55m., Bangkok, Siam. Heard very often around 11 p.m. with good signal strength. (Foster, Medina, Lee.)

XYZ.—6007kc., 49.94m., Rangoon, Burma. Another regular station on this band and audible at fair level. (K. Mc.)

Radio Saigon.—6116kc., 49.05m., Saigon, F.I.C. A very powerful station. English session from 9 p.m. till 9.45 p.m. (Cox, Clack, Ford, Foster, Lee, K. Mc., Medina, Emery.)

Radio Saigon.—11,780kc., 25.47m., same location. Also heard on this frequency with a very loud signal after 11 a.m. (Medina, Cox, Emery.)

PLP.—11,000kc., 27.27m., Bandoeng, D.E.I. On some occasions heard at excellent strength, while on others is practically inaudible. (Clack, Cox, Ford, Foster, Battis, Medina, Lee.)

NEW STATIONS

EACH month in this panel we will list all stations, definitely identified, which have not been previously heard, either at our own location or by our readers.

KC.	Metres	Call	Location
7,230	41.49	GSW	Daventry, England
8,500	35.29	LZA	Sofia, Bulgaria.
9,500	31.58	YUC	Belgrade, Y'slavia
9,705	30.91	DZF	Berlin, Germany.

PMN.—10,260kc., 29.24m., same locatio The same applies to this station, it varies greatly. (Clack, Cox, For Foster, Lee, Medina.)

PMH.—6720kc., 44.64m., same locatio Always a powerful station and hea every night, gives a number of Hawa ian numbers. (Ford, Clack, Cox, Fos ter, Lee, Emery.)

PMY.—5140kc., 58.31m., same locatio Not heard nearly as well as la month.

YDB.—9550kc., 31.41m., same locatio Now heard very much better at nigh (Clack.)

YDC.—15,150kc., 19.81m., same locatio This one has become a real standb on the 19-metre band and is know to all listeners. (Ford, Clack, Foste Lee, K. Mc., Battis, Emery, Medina.

YDD.—6045kc., 49.63m., same locatio Now interfered with very much b KZIB, but can sometimes be sepa rated. (Clack.)

YDX.—7220kc., 41.55m., Medan, Sumatra Another very strong Dutch East In dies station heard nightly. (Clack.

VUD2.—9590kc., 31.28m., Delhi, India Now one of the strongest stations o this band. Opens at 10.30 p.m. (Fos ter, Lee, Keast, Medina.)

VUD3.—15,290kc., 19.62m., same location Heard best around midday, but can also be recognised towards 6 p.m (Clack, Medina, Cox, Emery.)

VUB2.—4880kc., 61.48m., Bombay, India On some nights is quite good at 1 p.m.

VUC2.—4840kc., 61.98m., Calcutta, India Only heard weakly now at same time

VUD2.—4960kc., 60.48m., Delhi, India At 11 p.m. this Indian is R7 at Mr Emery's location.

JDY.—9925kc., 30.23m., Darien, Manchukuo. Now quite a powerful station on the air every night from 10 p.m English at 10.45 p.m. (Clack, Foster.)

MTCY.—6125kc., 48.98m., Hsinking Manchukuo. Heard every night, but not of any entertainment value. (Foster, Lee, K. Mc., Hallett.)

MTCY.—11,775kc., 25.48m., same location. This frequency is used for their session in English opening at 7 a.m. (Ford, Clack, Foster, Cox, Emery, Battis.)

JFO.—9635kc., 31.13m., Taihoku, Taiwan Always heard on this frequency, and also on some occasions on 9690kc with same programme.

JZJ.—11,800kc., 25.42m., Tokio, Japan Heard on some occasions in forenoon, also at 10.30 p.m. (Cox, Hallett, Foster.)

JZK.—15,160kc., 19.79m., same location This Japanese is heard in the afternoons from 3 p.m., and also at night at 10 p.m. English news usually given at 4.15 p.m. (Ford, Clack, Cox, Foster, Lee, Keast, Medina, Emery, Hallett, Battis.)

JZL.—17,785kc., 16.87m., same location. Heard best at noon, but very weak. (Hallett, Battis.)

JVW3.—11,720kc., 25.6m., same location. Heard best in the mornings at 7 a.m. (Foster, Emery, Lee, Medina, K. Mc., Clack.)

(Continued on Page 76.)

Hey Presto!

Abracadabra!

I was particularly pleased to receive photographs from the many who sent them along to me—thanks. From time to time we will publish some of these in our columns. It is amazing to me to learn just how many boys and young men are interested in magic as a hobby. It surprises me too, to find that quite a number of you have what I would call an "advanced" knowledge of this interesting pastime. Several readers actually sent me tricks for publication, one of which I will include in this issue, and he will receive a small magic book from me for his interest. If any of you care to send in a trick for publication, and provided it is suitable, we may be able to publish it, so get busy now, magicians. An exchange of ideas between us will no doubt be helpful to us all.

Again, I must remind those who expect written replies from me, not to forget the self-addressed and stamped envelope for reply. Any questions dealing with magic, ventriloquism or the associated hobbies will receive my personal attention and a written reply giving you the information or advice if possible. There is no charge for this service, it is FREE to our readers.

To my New Zealand readers, I would advise you to make inquiries about the big magician's Convention to be held at Wellington, N.Z., in March next year. A magician's party for magicians, lasting nearly one whole week. More news later. If you are interested drop a note to Mr. C. Henderson, c/o Box 1859, Auckland, C1, N.Z.

Meanwhile, "Piff-Paff-Poof."

Cheerio,

Barry Kent.

WHO'S WHO IN MAGIC

HAROLD JOB

Allow me to introduce HAROLD W. JOB, one of Sydney's popular professional magicians. "Harry," as he is popularly known to his friends, has appeared at many of the leading clubs, lodges, and other organisations in Sydney for a number of years. His wide experience in this sphere of magic and his close contact with magicians all over the world gives to him a never-ending fund of new stunts and novel tricks. He is the principal of Will Andrade Magic Store, of Sydney. Here, by every mail from England and America, arrives the latest in magic books and new apparatus.

Some time ago, he introduced to the magic fraternity of Sydney a new departure for a magic store in the way of a Magicians' Library of Magic Books. Here one can read, or take away each week one of the latest books published dealing with Magic. A nominal charge is made to exchange each book when desired. In this way, magicians who subscribe to the library may read books they might otherwise never purchase — merely for a few pence per week. I cannot recall a similar library devoted to Magic and its associated interests in any part of Australia.

And here's a big secret for you, and I hope he doesn't mind. Harry is actually one of the "Five Demons" I wrote about in our August issue. He specialises in tricks for clubs, house parties, and children's entertainments, for he is one magician who can successfully handle children. Signs of amazement, and roars of laughter ring from his youthful audience on every occasion.

A polished entertainer, with always a new twist to an old trick, plus "something" that never fails to mystify and entertain. When in Sydney, call and see him. As magic is his hobby, too, you will enjoy meeting him and perhaps seeing his magic library of over a thousand volumes of magic literature.

Harold W. Job.

TELEVISED MAGIC

Magic is popular with television audiences in London. Here you see Maurice Rooklyn, successful Australian magician in England before a television camera in the London studio. Rooklyn, who has been appearing in the principal theatres of England for the past three years, returns to Australia in June this year.

NICOLA'S CONFESSIONS

FOLLOWING the publishing of the Great Nicola's photograph in our "Who's Who?" column last month, the following confessions of his make interesting reading:—

Favorite theatre—New York Hippodrome.
Favorite part—Impersonations.
Favorite sport—Tennis.
Favorite hobby—Collecting curios.
Favorite book—The Bible.
Favorite song—The Rosary.
Lucky day—Friday.
Favorite dish—Ice cream.
Greatest ambition—To excel.
Favorite motto—I will.
Feel worst—When advance agent has neglected his work.
Feel best—When mail comes from home.
Pet aversion—People who sing (?) in hotel bathrooms.
Favorite spot for holiday—Paris.
Favorite trick—Have none.

* * *

ESPERANTO MAGIC

A NOTE from New Zealand tells me that Ross Robbins, a Wanganui Magician, is a keen Esperantist, and has on many occasions worked his programme while speaking entirely Esperanto. He says that the egg bag goes over just as well as it does in English. Novel, eh?

* * *

MAGICIAN'S CIGARETTE HINT

WHITE soft rope about the width of a cigarette, if cut into lengths about three inches long, appear from a distance to be actually cigarettes. They will when lit burn for hours with a'l the characteristics of real cigarettes, and stay alight for hours.

by Barry Kent

MAGIC AND MAGICIANS

IS CHINA MAGIC'S HOME?

China! India! Egypt! The very mention of these countries brings to the mind thoughts of mysticism and unexplainable phenomena. These countries have all contributed greatly to the present-day art of magic.

NOT only have they given us great magicians from time to time and likewise some astounding creations in actual tricks and illusions, but they have supplied a wonderful background of all that breathes mystery and mysticism.

Such ancient miracles as, "The Tomb of Belus," "Cagliostro's Crucible," "The Oracle of Delphi," and many others, come to us to-day, with the great mystery background of the East.

But what of the mysteries of ancient China? They, too, are many. China has given us some wonderful tricks and a number of outstanding performers, many of whom have appeared in Australia. It is remarkable, however, that quite a large number of "Chinese" performers who have appeared throughout the world as magicians, are NOT Chinese at all. Perhaps the greatest "Chinese" magician, ever to appear with a really big magic production was actually a Scots-American. The "Chinese" name is no doubt well known to you all—CHUNG LING SOO.

Here was a really great magician, and one whose name will live for all time among the masters of magic and mystery. CHUNG LING SOO in real life was a Scots-American, named William E. Robinson. SOO was supposedly a court conjuror of China, and he won great fame abroad, both in America and England for many years before his identity was discovered, this however, only added to his great popularity.

KILLED BY ACCIDENT

It is sad to relate that Chung Ling Soo was accidentally killed during a performance, in full blaze of the footlights, some years ago at Wood Green Empire Theatre in England. A crowded audience looked on, thrilled and horrified. SOO was shot while presenting his great bullet-catching illusion. Four examined bullets were openly loaded into four rifles, and then fired at SOO who would catch the four previously marked bullets on a plate held a few inches in front of his body.

He was not the first magician to be killed while presenting this dangerous illusion. Over and over again, his friends begged him to give the trick up, but he persistently refused. He knew the great drawing power of this particular trick with the public. What was Soo's secret? How did he do this great mystery?

It is coincident to relate here that during the time Maurice Rooklyn appeared in the leading theatres of the United Kingdom, he appeared at the very theatre where Soo was killed. This was only a few months ago, not long before he returned to Australia. In a letter written to me from him while appearing at the Wood Green Empire, Rooklyn penned me several very interesting items about the theatre and Chung Ling Soo. It will be remembered too, that Rooklyn was injured while performing a similar trick at the Sydney Tivoli Theatre prior to his visit to London.

Much has been written regarding the actual cause of Soo's failure to perform this trick on the night in question. What the cause was will never be known.

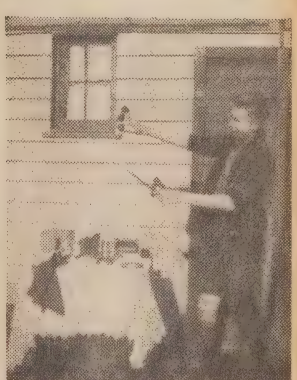
MAGNIFICENT ACTOR

Soo's real greatness was due to the fact that, in addition to being a great magician and having a spectacular show, he was a magnificent actor. This, above all, is perhaps the most necessary quality one can have in his aim to be a great magician. Soo's make-up as a Chinaman was perfect, and he deceived people all over the world into believing that he was really an Oriental. He was so wrapped up in his profession which was his hobby, too, that he lived, thought and acted as an Oriental frequently for twenty-four hours of the day. He used to say that at times when he was on the stage, he almost forgot he was an American.

Yes, Chung Ling Soo, like many other great magicians and great leaders of commerce, had the necessary qualities to take him to the heights of his profession. Whether you are in the magic profession, the medical profession, the legal profession or business, to be really GREAT, you need more qualities than one. Soo had those qualities which help to build greatness, and perhaps the most outstanding one was persistence . . . and with persistence comes success.

Next month: Escapology—Hand Cuffs—Straight Jackets, &c.)

CLEVER BOY MAGICIAN



Norman Hooper

Magician Norman Hooper, of 22 Or mond-street, Kensington, Victoria, is keen student of magic—a reader o "Radio and Hobbies," and a clever mag ician.

For his birthday recently he receive a number of new tricks to add to hi programme. Norman has a pen-friend aiso a reader of this page, who is little older than Norman. Both thei birthdays are on the one date—Augus 21, both have magic as their hobby, an both keen readers of "Radio and Hob bies," further more, both magicians ar named Norman. Well, I think that i REAL MAGIC.

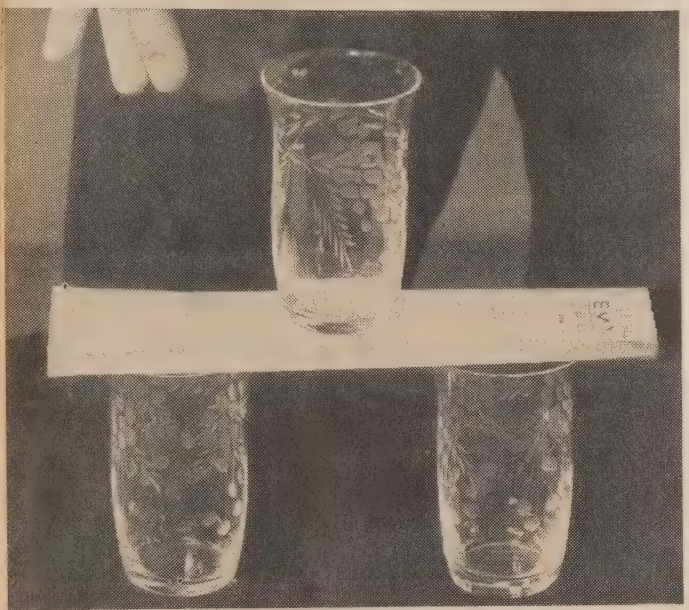
(Congratulations to you both, an Many Happy Returns.—Ed.)

MATHEMATICAL PROBLEM

SOLUTION TO PROBLEM

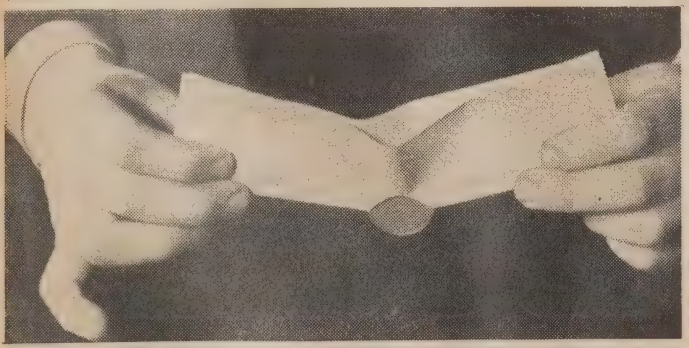
THE correct solution to the Mathematical Problem is our August issue is 20 five-eighths inches and 12 three-eighths inches. A free book has been posted to the winner, F. J. Allen, Boulder, W.A. The solution which appeared in the September issue was intended for a tape measuring 36 inches long, instead of 33, as published.

IT APPEARS QUITE IMPOSSIBLE



Take three glasses and a piece of white paper about ten inches by eight, and challenge your friends to place the paper across two of the glasses and have it support the third. This, of course, seems impossible. HOW? Take the piece of paper and pleat it with small folds about a quarter of an inch, then place this across two glasses, and it will easily support the third if placed in the centre.

THROUGH THE EYE OF A NEEDLE



Can you make a penny pass through a hole in a piece of paper—the hole being much smaller than the penny.

NOT SO EASY, EH? It is easy when you know how! Just drop the coin into the centre of the paper and, to everyone's amazement, the coin will pass through the hole. Merely bend the paper up at the ends. The hole will temporarily enlarge, and allow the coin to pass through with ease.

FROM FATHER TO SON!

Magic A Great And Useful Hobby

At present in America there is a great magician named Frakson, who is appearing with great success everywhere. Recently he contributed a short paragraph to "The Sphinx," which I think is worthy of passing on to you.

His article was headed, "My Sons Must Learn Magic," and it contained the following: "Now I know that my father was right. He was a magician, and he made all his children also learn to be magicians.

"He did not care whether they made magic their life work, for, as he said to me, 'When you are grown you may take up any honorable occupation you wish, and I shall not interfere in the slightest manner. But now, as a boy, you must learn to be a magician.' I was not interested in magic as a boy, and did not enjoy having to practise, particularly as my father insisted that everything I did must be done well.

LIFE WORK

"When I became a man, I had developed an interest in magic and made it my life work, but that is beside the point. My father's idea was that magic as a study offers more aid to a man, no matter what his profession or business, than any other study.

"Magic teaches one to understand people and to know how to deal with them. It teaches poise and co-ordination. It is really the best possible course in public speaking. One also learns from magic a great deal about psychology, mechanics, salesmanship, and a hundred-and-one other things for which a person is paid well in the business world.

SONS WILL LEARN

"To-day, I am making my sons learn to be magicians. Unlike myself, they both enjoy magic, and, discounting a father's pride, even now they are quite skilful. I do not have any idea of planning their future, and they will have my blessing no matter what their business is. But before they have reached the age where they can go out on their own, they must learn to be good magicians. I want my sons to be successes in life, and I know of no better training for their youth than the study of magic.

"To-day, I know that my father was right."

MAGICAL NEWS

ANOTHER YOUNG STAR—DEATH OF SWORD-SWALLOWER—A COOL JOB

FROM England comes the news of the death of Chevalier Cliquot, one of the most famous sword-swallowers. He died recently at the age of 69 years. At one time, when appearing professionally, he used to swallow a 3-foot sword as part of his entertainment. He bequeathed his body to the hospital, so that science could see for itself a throat that one time could swallow a 3ft. sabre.

* * *

LAST month we published a photograph of Daphne Smith, of London, a girl magician of merely 7 years. Magic must be popular with our English friends, for another young lady, Miss Lucille Barnett, aged 14 years, has commenced her professional career as a magician. Lucille has appeared on the stage and concert platform in England. She has been filmed and televised, and tempting offers have been received from both stage and screen companies. Lucille is described as a bonny lass, dark-haired and smiling, with patter that entertains and amuses, and tricks that amaze all. We are not alone in Australia for youthful magicians, judging by the number of photographs I have received from reader magicians.

* * *

A "COOL" trick—cooler than any cucumber. At a Melbourne amusement park recently, Miss Myrtle Annette allowed herself to be imprisoned for five minutes each performance in a shell of ice. Just you imagine, sealed in a block of frozen ice—and yet lives. Is it an illusion, or is it a trick?

* * *

NO TRICK IN THIS

A ONE-RING circus was visiting a country town. The people there recognised all the instruments of the band except the slide trombone. One old settler watched them for some time, and then, turning to his son, said: "That's no trick, son—don't let them fool you. No. There's no trick to it—that fellow playing that thing ain't really swallowin' it."

* * *

HAVE just received my copy of "Te Tohunga," the New Zealand magazine for Magicians. It contains: Latest Magical News; "Try These Tricks"; "Earliest Magican Society in N.Z."; "Magic Carpet of Maoriland"; "Memoirs of a Wax-works Showman"; and News about the 1940 N.Z. Magic Convention. Twenty-four pages of excellent magic reading and items of interest. The back page (cover) gives a photograph of the opening scene from CHANG'S Mighty Magic Revue.

* * *

DURING the month in Sydney we saw the departure of Roselli don Leonardo for New Zealand. He has been appearing all over Australia until recently with various leading shows. Magic, rope-spinning, and other novelty acts, all of a very high standard, are included in his various performances. He also has a very intelligent trained dog, "Laddie"—and I can quite honestly say that "Laddie" really enjoys his work. Another Australian, Gilbert, who recently toured the country with Wirths' Circus, returned to Sydney during the month. Gilbert was until some little time ago a very successful escapologist, and it was with this act that he toured with Wirths' Circus—nothing can hold him. His future movements at the moment are not certain.

I TALK WITH CHANG

ISN'T it wonderful? A few days ago a note received in Sydney from the mighty Chang, recently here in Australia, and now on his way to conquer new fields in South Africa, said this: "Passing through Adelaide, I saw Nicola's show—I liked him very much, both his show and Nicola personally He has a good company and very good tricks—he puts it over well." Now, that's a wonderful feeling as magician to magician. Very often we hear the opposite expression of opinion when one magician is asked his opinion of another's performance. Here, you see, the really great magician can see the excellence of the other's show. No doubt if Nicola was asked his opinion of Chang's show he would reply in similar terms. This reminds me, too, of the occasion when Nicola was leaving London last year, he spoke so highly of brother magicians in England. He said that Horace Goldin had a better show to-day than when he saw it previously in Germany some years ago. Nicola also said that Dante certainly took the palm for personality and looks among the world's magicians, and that he was the one magician in the world who really looked like a magician. Furthermore, in Nicola's opinion, Dante's greatest and best thing in his entire show was Dante himself. In discussing other great magicians in London, Nicola said of Cardini. "He is so perfect he could not be better, and if he performed real magic the result would be the same."

Magicians, look for the best in other magicians' performances, and don't be afraid to tell the world. You will gain, your magician friend will gain, and above all magic as a form of entertainment will continue to benefit.

CAMERA SPEEDS AND APERTURES

How to judge them

Anyone can take a reasonably good picture these days, but it still takes care and knowledge to make the best pictures. In this article, Frank is initiated into the mysteries of speeds and apertures. It all happened the other day—

By GEORGE WHITE

"WHAT'S all this highly technical talk I hear about f-numbers?" Frank asked. He dropped in on his way home from golf—he has decided that he can afford both golf and photography. "I hear mention among the experts of these mysterious f-numbers and can do nothing more than nod knowingly and say nothing—a pretence which cannot be kept up indefinitely."

"There's nothing technical or mysterious about them," I said. "In fact, it's pretty plain sailing. The f-numbers on your camera—usually indicated just below the lens—denote the size of the aperture. In simple terms, this means that the size of the aperture regulates the amount of reflected light which can pass through your lens onto the sensitised film.

MORE LIGHT—LESS EXPOSURE

"It's pretty easy to see, therefore, that the greater the intensity of light which passes through the lens (that is, the larger the aperture) the shorter the exposure necessary, and vice versa. As you put down to a smaller aperture, so you must increase the length of your exposure."

He said, "Rather like cutting down the length of your drive and increasing the number of strokes."

I refused to be drawn into a side-discussion. "Usually, in the cheaper box or folding types of cameras, there is one stop or f-number—and that is not marked. But, in nine cases out of ten this f-number is f/16. Sometimes there are two. In this case the larger is nearly always f/16 and the smaller f/22, or, sometimes, as small as f/32."

"And that," Frank discovered, "is all you have to know in order to take successful pictures. Well, well!"

"No," I shook my head. "That is scarcely the beginning. There still remains the subject and its relation to aperture and exposure—and different kinds of subjects require vastly different exposures and/or apertures. There is such a thing as a 'normal' subject. As I think I've said before, you can't get along without an exposure guide of some kind—even if it is only one of the cheaper, sliding-scale reckoners like those that Ilfords and Wellcome put out.

"In these a 'normal' subject is one with a more or less open space in the foreground, the subject being not too big and about 20 feet away and well lighted from all quarters of the sky.

"To illustrate my point that there is a big variance between necessary exposures, a scene which includes sky, clouds, beach scenes, snow landscapes, panoramas, open sea, etc., will require an exposure as much as one-sixteenth to half that required for a normal subject.

"Then again, if your subject is dark, or has in it dark masses which are near the camera, or even if there are heavy shadows a little way off, the exposure will have to be as much and sometimes more than twice that needed to photograph an average subject.

"You have to remember, too, that sunshine at different times of the year varies considerably in its intensity—even though it might seem the same. This is invariably allowed for in exposure calculators. And, on top of this you have to consider weather conditions.

"As a rough guide, say that your exposure calculator instructs you to give a 1/100th of a second exposure at f/4.5 for a particular subject which is lighted by clear sunshine with a white-cloudy sky—which is the best natural lighting obtainable. Very well, it is easy to work on from that.

"Thus, if there is sunshine and a blue, cloudless sky, the exposure factor will be 2—that is, half the above, or 1/500th of a second at f/4.5. If light is coming from a sky that is cloudy but bright—that is, no direct sunshine and no dark clouds, the factor will be 4—or 1/250th at f/4.5. A dull day with greyish clouds will need about 1/100th, and a very dull day with heavy clouds will need 1/50th of a second."

"But how do these stops which are f-numbers (aperture-sizes) work, and why?" he wanted to know next.

"Well, briefly, the faster your lens the larger the stop. By this, I mean you can cut a f/4.5 lens down to f/16 by decreasing the aperture. But you can't use f/16 successfully at a high exposure speed in a bad light (in order to stop, for instance, a cantering horse, or a footballer or other action). To do that you need the fastest lens you can get—and, of course, the fastest film.

"But, in a really good light, it is an advantage to stop down to a small aperture and increase the exposure accordingly, for this will give you greater detail and greater depth of focus. Incidentally, you will find that if you stop right down, your focus will give sharp definition to everything from within a couple of feet in front of your camera to infinity."

"I'm still waiting to hear what I asked," he said.

"And I'm still coming to it. It's this—each smaller stop—that is, the stop which has a higher number than the last—needs twice the exposure of the one preceding it. Thus, if a certain subject needs 1/100th of a second at f/8, it will need double (that is 1/50th of a second) at f/11. And so on. The largest or fastest stop on your camera however, is often an exception. For instance, f/4.5—which is faster than f/5.6—needs five-eighths the exposure of f/5.6, and not one half as might be expected. Similarly, f/3.5 will need to be given only three-quarters of the exposure you would give for the same subject at f/4.

"So there it all is briefly. At least there is enough to give you an understanding of exposure calculators. The Ilford Reckoner takes six factors into consideration: light values, weather conditions, H & D speed numbers (that is, the speed of the film-emulsion—different emulsions have each a different speed), the type of subject, the stop you wish to use, and the exposure. Of these the light values and the exposure are fixed; the other factors are accounted for by a sliding, adjustable scale comprising two strips. Most other similar reckoners operate on the same principle."

Frank picked up his golf bag and perpetrated a horrible pun. "I think I'll go out and hit a couple of speedy balls while the light values and weather conditions are good," he said. "After that, maybe I'll stop over at the club-house and expose myself to a couple of average subjects."

I have a lurking suspicion that he had been more intent on working all that out than on listening to my advice.

AN EXPOSURE TIMER FOR PRINTING

Here are a few points on enlarger technique which may help you to obtain better pictures.

Vibration is a factor often ignored, and in many cases is responsible for lack of sharpness in an enlargement. The practice of centring paper with an orange safety glass and exposing by capping and uncapping the lens with this glass is to be deplored. It is a far better idea to use a paper holder and blank sheet, and use the projector lamp switch for exposure control. Furthermore, the switch should be of the "cord-grip" variety, located in the power cord, with a good length between switch and enlarger. In this way we eliminate the tendency to vibrate the enlarger when the switch is operated.

Stand quite still whilst exposure is taking place, and make sure that vibration is not transmitted through flooring from other rooms.

WHAT WENT WRONG?

It is hard to know what happened to this print. Certainly, there are quite a number of faults. For one thing, the camera was obviously moved just as the trigger was pressed. Cameras, when taking a picture, should be held firmly against the body; at the pressing of the trigger the photographer should hold his breath. As usual in many amateur pictures, there is in this case, too, more foreground than is necessary. Great expanses of grey like this confuse the eye and detract from detail. Stains and spots are also evident on the print; but, without seeing the negative, it is impossible to give an opinion as to how they originated. Possibly it was due to faulty washing of the negative after developing and fixing.

PLANES OVER EUROPE

A fleet of the famous Vickers "Wellesley" long range bomber and general purpose monoplanes in full flight. These machines are powered, each with a single "Bristol" Pegasus engine. It will be remembered that three Vickers "Wellesleys" recently flew non-stop from England to Australia.

THE IMPORTANCE OF MILITARY AIR MASTERY

IT is as yet too soon to say much about the relative merits of the fighting planes which are swarming in clouds over Europe. Time alone will tell which machines are most effective in actual combat.

There is not the slightest doubt that in this war the mastery of the air will be most important.

Remarkable strides in the development of aviation can be attributed to the last war, great changes in design taking place in the period 1914-1918. Development should be fostered at even greater pressure now, as the value of the aeroplane as a weapon is known and fully appreciated. No efforts will be spared to attain superlative performance.

From early reports it is also evident that a great many planes will be required for replacement purposes, as anti-aircraft guns are proving quite effective.

If wartime production of planes amounts to hundreds a day, we can expect some exceptionally attractive commercial planes to be offered after the war is over. Factories which have worked on a mass production basis during hostilities, will make every effort to keep up their turnover when peace comes.

It is hard to imagine that at the beginning of the Great War in 1914, aeroplanes were not expected to play an important role, apart from possible use as observation units. The pictures given here illustrate the enormous strides since those early days of open framework and basket seats. Already, aeroplanes have shown what a big part they are to play in the present conflict.

WHOSE ARE FASTEST?

It is perhaps to be expected that one often hears the question, "Whose fighting planes are the fastest?"

Actually, there is no concrete answer to the question, as reliable figures on speed capabilities are not available.

As it happens, speed alone is not such a vital factor. Much was heard of the speed of the German "BF109" monoplane, which was claimed to hold the world's speed record for land planes in 1937. A few months later, when actually in use in Spain, these planes did not prove as effective as might be expected.

It was claimed that they were completely out-flown by Russian-built planes of a type similar to the American. Incidentally, the speed of the BF109 was given as 379 m.p.h., obtained when powered with a 950 h.p. Daimler-Benz engine.

GERMAN BOMBERS

Germany is known to have a vast fleet of bombers, the Heinkel "HE111" being a typical example. It has a rated speed of 300 m.p.h., when equipped with two 910 h.p. engines.

Another German plane of which much has been heard is the Heinkel "HE112," a single-seater fighter, powered with two 650 h.p. Junkers engines, to give it phenomenal speed.

Reports about this machine in the Spanish conflict were also disappointing, however, as it was found very difficult to manoeuvre.

FRENCH BOMBERS

France has an effective air force; about seven thousand modern planes, ready for immediate action. The performance figures for these French planes appear to be quite imposing.

For example, the "Amiot" long-range bomber has a total flying weight of 17,600lb., can carry 3300lb. of bombs, and yet fly 1240 miles at nearly 300 miles per hour.

One of the amazing claims made for this plane is that it can operate at a height of 32,800 feet (about six miles high!). It is said that France has 600 of these long-range bombers ready for service.

THE BRITISH

As might be expected, Great Britain has an effective air force, and although figures are not available, it is fairly safe to assume that all of the British types can readily hold their own with similar types employed by foreign Powers.

At least 30,000 war planes are owned by England, France, Poland, and Germany. The latter has 12,500 of this total. Russia and Italy together have about 19,000 planes.

An interesting British bomber is the Handley-Page "Hereford," which is fitted with two Napier-Halford "Dagger VIII." engines, each rated at 860 h.p. These are remarkable motors, each having 24 cylinders in two upright and two inverted banks, with twin crankshafts geared together.

Other types of British planes to receive world recognition as masterpieces of design are the Bristol "Blenheim" and Bristol "Beaufort." These bombers are of a most advanced type, and even the caustic American aviation writers admit their merits. The remarks of the same writers when dealing with the Avro Ansons are quite unprintable! It was expected that a large number of "Beauforts" would be made available to the R.A.A.F., but doubtless these arrangements will be upset under the present circumstances.

Apart from the actual fighting planes and bombers, there are many other types of aircraft used in modern warfare, and of great importance are the scouting planes used for spotting for the artillery and generally getting a survey of the enemy's activities. For this type of work Britain has a very effective little plane in the Westland "Lysander," a group of these spotters being shown at the top of this page.

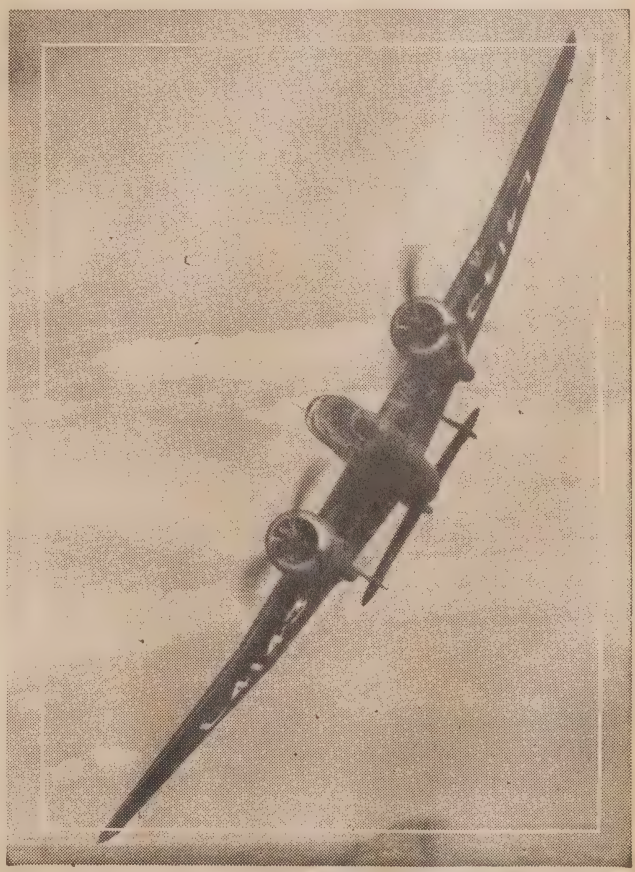
The "Lysander" has been designed for observation work, and provides maximum visibility for both pilot and observer. It is not especially fast, rated to do about 220 m.p.h., with a Bristol "Mercury" engine, but has a low landing speed, made possible by the use of wing slots and flaps. The "Lysander" is even fitted with a hook device for picking up messages from the ground without actually landing.

RESULTS

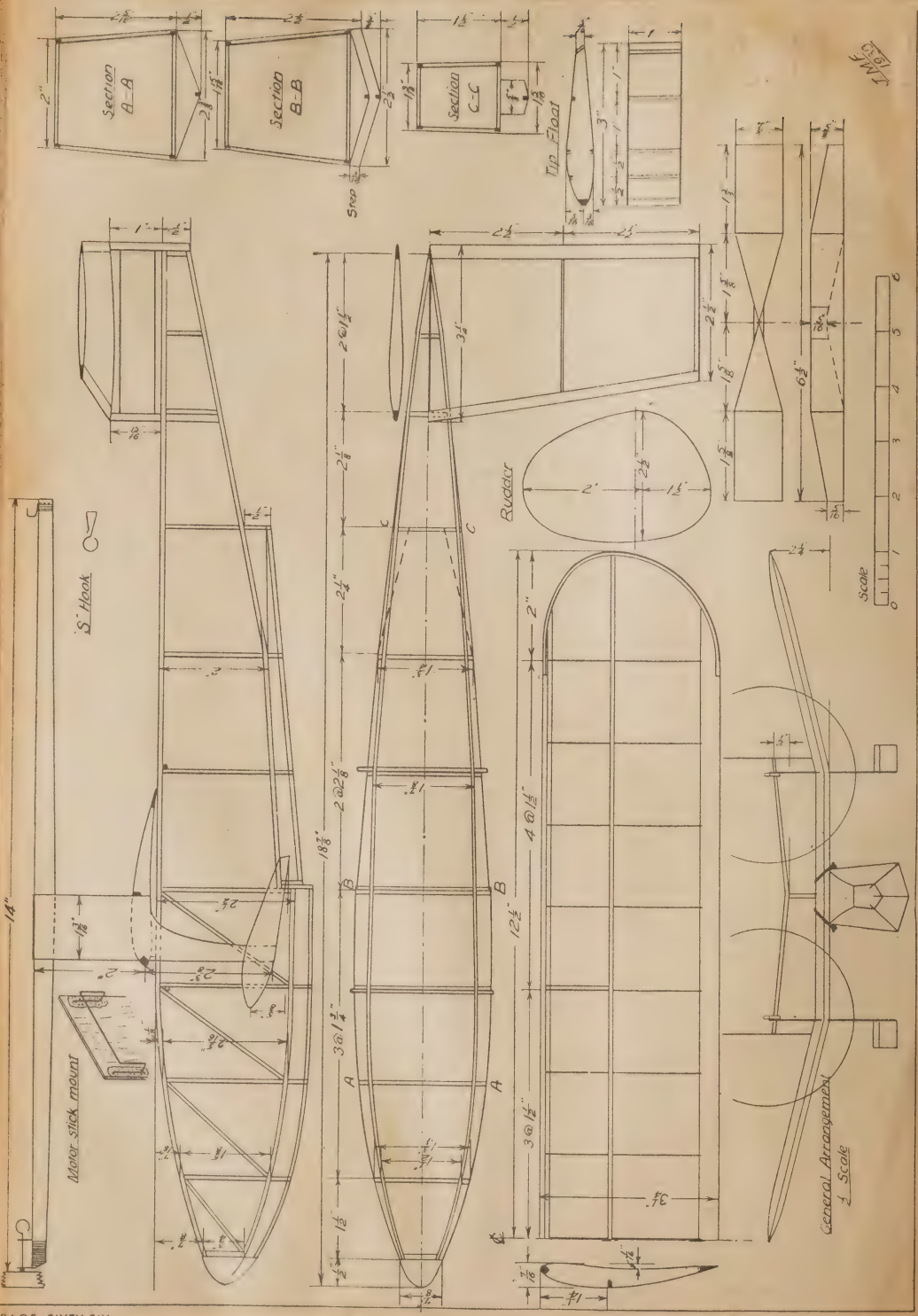
So far the war has opened without the amount of air-raiding which was expected in some quarters. Up to the time of writing there has been no attempt to bomb England or France, and English raids have been directed only at military objectives.

Apparently a lot of air-raiding has been carried out in Poland, but news of the fighting is so scarce that there is little to indicate the comparative value of the various types of aircraft, the effectiveness of anti-aircraft guns, and so on. These matters are of great interest to keen students of aviation development, and future reports are sure to be followed intently.

A strikingly beautiful photograph of Lysander Aircraft practising for an Empire Day Air Display in Hampshire, with camouflaged wings and fuselage. Although these are well-known fighting planes, they look anything but warlike as they soar in formation over the beautiful English countryside.



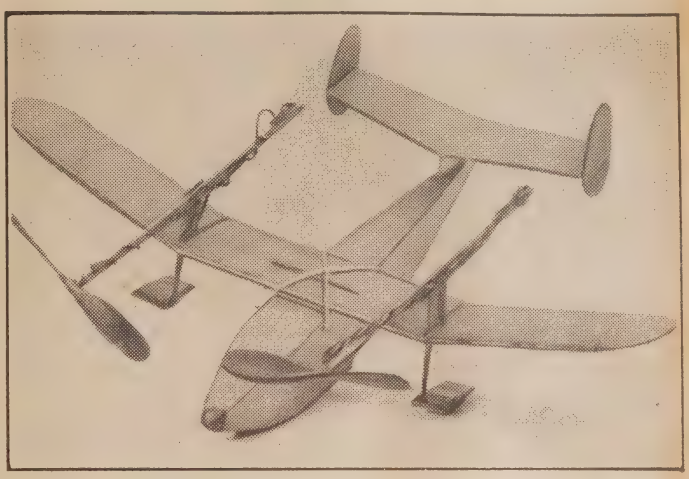
Here is a Handley-Page Hampden bomber banking steeply. The extreme narrowness and great depth of the fuselage are conspicuous, and the outlook provided for the pilots clearly brought out. The Hampden is powered with two 1000 h.p. Bristol Pegasus XVIII motors.


Section A-A
Section B-B
Section C-C
Tip Float
Rudder
'S' Hook
Motor stick mount
General Arrangement
1/4 Scale
Scale
1 MF 6181

A MODEL FLYING-BOAT

by Jim Fullarton

This month we present a unique model which has proved itself to be thoroughly practical and successful. It is the first actual model of a flying boat to be described in an Australian journal. Its designer is one of the best-known figures in the model flying world.



Compare this diagram with the drawings on the opposite page. A number of constructional details are here made clear, including the mounting of the motor sticks.

THE latest trend in the civil aviation of all countries is the construction of bigger and better flying boats, this being definitely the most suitable type of aircraft for the trans-oceanic transport of large numbers of passengers in comfort and safety. Accordingly, a few months ago, we were inspired to produce a model of this type, just to see what would happen, and, if successful, to serve as a guide for the construction of a larger model powered by a petrol engine.

Right from the first trial flights, results far exceeded expectations, and we can highly recommend the design to the modeller who desires something different.

SPECTACULAR

Any pool is your flying ground, and to see it skim across the surface of the water for a few yards then shoot up in a steep climb with drops of water still falling from the shining hull, certainly provides a first-class thrill. To those who say "It can't be done," we refer to the splendid action photo by Malcolm ("Wee Mac") McGregor, of the original in a downwind take-off from a pond in Centennial Park.

The construction is quite straightforward, and a few nights' work will see the job completed. Twin motors were decided upon for various reasons, and with two airscrews rotating in opposite directions, the all too familiar bugbear of torque reaction is completely disposed of. And, of course, a dihedralled stabiliser with twin rudders is right in keeping with the best modern practice

The hull lines were taken from the Saunders-Roe Flying Cloud amphibian of some years back, and are very efficient on the water. So now get your pencil and paper, your balsa and razor blades and get down to it.

The first step is the preparation of full size working drawings of all framework. This includes drawings of the complete wing and tail of which only halves are shown in the plans.

The hull is constructed similarly to the ordinary fuselage. That is, two sides are made and joined together with cross-stays to produce a structure flat on the top and bottom and with sloping sides.

Longerons are 1-16in. x 3-32in., and cross-stays are all 1-16in. square hard balsa. To obtain the curve in the nose portion, soak with methylated spirits. The V bottom is then built up by cementing on triangular formers of soft 1-16in. At the front step there are two formers, one 3-16in. higher than the other. The sides tapering in to the near step, as shown by the broken lines on the plan, are formed of 1-32in. balsa.

The nose piece is a ¼in. block of soft wood, shaped after cementing in position. The two vertical struts of the stabiliser support are then cemented in position, the front one being 1-16in. lower than the rear, and is attached to the centre of the top and bottom cross-stays at that point.

The negative incidence is necessary in the stabiliser due to the nosing over moment caused by the high thrust line. Cement in place the 1-16in. square bamboo pegs for the wing mounting rubber bands, and cover with tissue, excepting the under-surface back to the rear step, which is covered with 1-64in. sheet. For the tissue use thin cement or dope as adhesive, and be sure to leave no holes.

WING

This is made in one piece. First make a rib template of metal or cardboard and cut 15 ribs from stiff 1-32in. sheet.

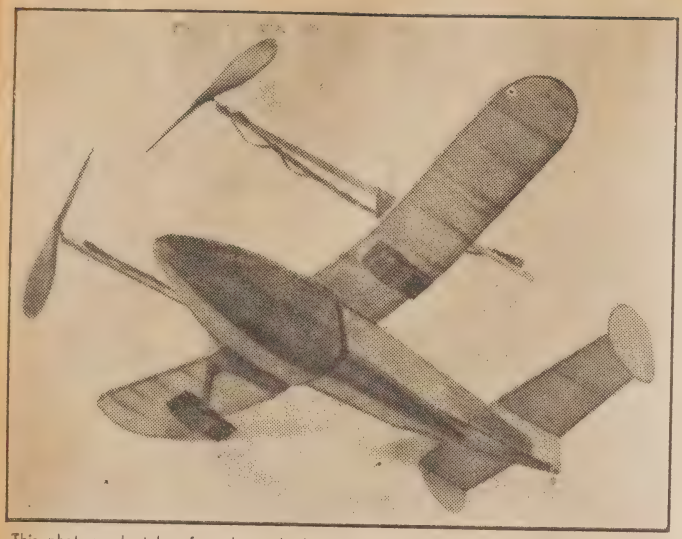
The tips are made from bamboo by bending a 1-8in. x 1-16in. strip of bamboo over a candle or low gas flame, and then splitting into two halves. If you don't like bending bamboo, you may build the tips up from 1-16in. sheet.

The trailing edge is prepared by sanding or planing an 1-8in. x 3-8in. strip to triangular section, and cutting slots in it 1-16in. deep with a hacksaw blade for the ribs.

The framework is first assembled without the centre spar, which is put in after the dihedral angles have been imparted. The leading edge is hard 1-8in. square balsa on edge, the centre spar 1-8in. x 1-16in.

OUR CONTRIBUTOR

Jimmy Fullarton, No. 1 man in Australia's "Wakefield Cup" team, is recognised as one of Sydney's most versatile modellers. Although still only a lad he is an "old-timer" at the competitive side of the game, and the sideboard at his home accommodates more than a dozen cups, and other trophies. Jim has been most successful in local competitions but he has also enjoyed success abroad, sending his models overseas to be flown "by proxy." As captain of the Bondi Black Hawks Club he materially assisted their team in the winning of the Interclub Challenge Shield.



This photograph, taken from beneath the model, gives a good idea of the hull construction. Note the step under the wing, as in a full-sized flying-boat.

The pieces forming the motor stick mounts and tip float struts are cut in one piece from 1-10in. sheet, and cemented firmly to the wing ribs and spars.

The motor stick clips are bent from 22 gauge wire to a snug fit to the stick, and cemented to the mount so that the motor-stick is horizontal. An incidence block of 1-8in. thick is cemented under the leading edge at the centre.

The tissue covering is applied to the wing with the grain running from leading to trailing edge. This minimises sag between the ribs, and also reduces the tendency to warp when doped.

THE STABILISER

The stabiliser construction is similar to the wing. The leading edge is 1-8in. x 3-16in. hard balsa rounded to shape, and the trailing edge is 1in. x 1-16in. The ribs are of symmetrical section cut from 1-16in. sheet.

The spars are cracked and cemented in the centre to give 1in. dihedral under each tip. The stabiliser is cemented to the mount, to line up parallel to the wing. It is covered on top and bottom with tissue. The rudders are cut from 1-32in. soft sheet and cemented securely to the end ribs of the stabiliser.

The motor sticks are cut from hard 1-8in. balsa, 3-8in. deep in the centre, tapered to 1in. at each end, and 14in. long. The double bearings are made by punching holes with a gramophone needle in each end of an 1-8in. strip of aluminium 3in. long, and bending to shape. They are bound and cemented securely to the motor stick, being careful to keep the thrust line straight. The rear hook is bent from 22 g. wire, and is bound and cemented securely to the stick.

Although small, the airscrews must be carefully carved, or the performance will be affected. They are carved from medium balsa blocks 7-8in. x 5-8in. x 6½in. long. Cut the blank accurately to the outlines shown, and when carving keep both airscrews evenly matched, making one left and one right-handed. Each blade should have 3-64in. undercamber at the widest part, where it should be about 1-32in. thick. Balance on a shaft through the centre; round the tips, and cut away the centre portion as shown by the broken lines, and balance again.

The shaft is a piece of 22 g. wire bent into a U shape, embedded and cemented into the hub. For washers, small beads are excellent, and don't forget a little vaseline here when flying. Each rubber motor is composed of four strands (two loops) of 1-18in. x 1-30in. rubber, 13in. long, although it will fly on two strands of 3-16in. x 1-30in. For winding, an S hook is attached to the rear of the motor. It is possible to get 800 turns on the motor. The final details are the tip floats. These are made of 1-32in. sheet sides, joined with 1-16in. square cross braces, and covered on the bottom with 1-64in. veneer, with the grain running across. The tops are tissue covered, and they are cemented to the outsides of the struts at the angle shown on the plan.

The whole model is given one coat of dope and then lacquered the required color. Use two coats of thinned lacquer on the hull and floats, and one coat on the rest of the structure.

FLYING

First test the model hand launched over long grass. The wing position is not altered, but the centre of gravity is adjusted by moving both motor sticks forward to cure a stall and backward if the model fails to climb. It should balance with the sticks supported approximately at their centres, and if it fails to respond to this adjustment then the incidences or the thrust lines are out.

Be sure the wing is square with the fuselage, as any movement here affects the thrust line as well. Owing to the low centres of gravity and lateral area and the high thrust lines, the model is easy to fly and very stable, and can pull out of a stall in an amazing manner.

When you have it climbing steeply and gliding steadily, you are ready to try a take off. A calm day is best, but if there is a slight breeze, the model will make a surer take-off down wind, as the breeze boosts its water speed and assists it to rise and plane on the step.

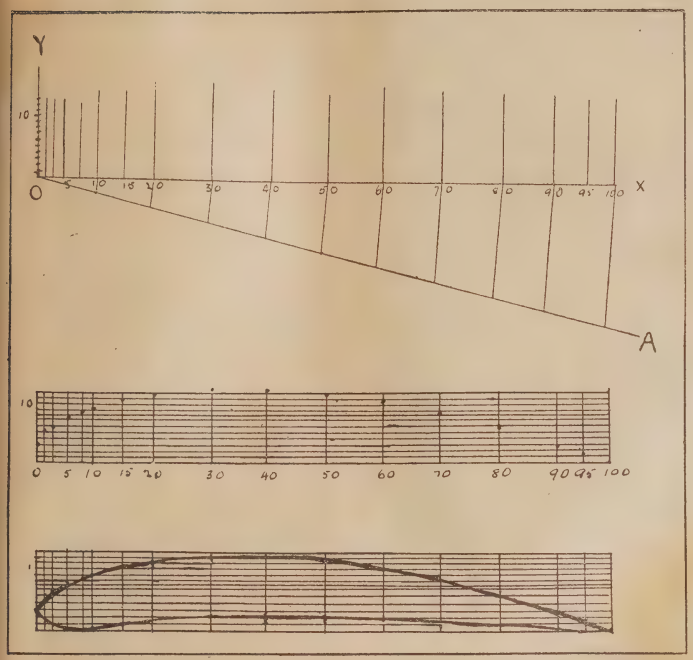
On full turns the take-off run is about ten feet. The only trouble you may experience here is a tendency for one tip float to dig in and swing the model round. This is prevented by setting the rudders for a turn in one direction and leaning the model in the opposite direction when launching.

The best time to date by the original model is 40 secs. R.O.W., but this time can be bettered. We are confident that you will be very pleased with the performance of this little job, and would be interested to hear from those who have built it.

This picture is the result of a quick "snap" of the plane leaving the water. Just to prove that it does fly!

HOW TO PLOT AN AEROFOIL

for better 'planes



These drawings show the various stages in the layout and plotting of the Eiffel 431 Aerofoil.

By
JOHN CAVILL

In more and more plans the wing section ordinates are being given. So that it becomes most necessary to be able to plot an aerofoil from these ordinates.

ONCE the principle is understood, the actual plotting is quite simple. The numbers in the table refer to the positions on a graph and the first job is to lay out the graph.

First set out the two axes, OX, OY. The line OY, of course, should be perpendicular to OX, and OX should be the length of the desired wing section, or, in other words, the chord of the wing.

The problem now becomes one of dividing the line OX into ten equal parts. If this cannot be done by measurement, it must be done by geometry.

Draw the line OA. It may be any length and at angle to OX. Mark out along OA ten equal parts. Just open up your compasses to half an inch or so and mark off the points. Join the last of these points to X and then draw a series of parallels. These parallels will divide our line into ten equal parts.

Through these points construct perpendiculars and mark off the sections from 10 to 100. The first section should be further divided into four equal parts, and the first of these quarters further divided. This can be done easily by measurement. The section 10 to 20 should be halved, as should the section 90 to 100.

Now it is necessary to mark off from 10 to 15 units along the vertical line. The number depends on the height of the section.

Through these points further parallels are drawn.

This gives us the graph and now we consult the ordinate table for our points. The first measurement we see is Station O, Upper 3.00, Lower 3.00. So we take the line OY and measure up three units and mark a point there.

First we will mark in the upper camber, so we read down the table and mark off the points. At Station 1.25 we read the upper camber as 5.00 units, so we measure up the line marked 1.25, 5 units, and place a point there. Thus the whole of the top camber is plotted, and then the lower camber. These points are joined and there we have the aerofoil plotted in the most accurate way possible.

Station	Upper	Lower
0	3.00	3.00
1.25	5.00	1.16
2.5	5.78	0.56
5	7.10	0.14
7.5	8.11	0.00
10	8.90	0.30
15	10.45	0.82
20	11.40	1.50
30	12.30	2.50
40	12.20	2.80
50	11.50	2.50
60	10.00	1.80
70	8.00	1.20
80	5.70	0.80
90	3.00	0.40
95	1.52	0.14
100	0.00	0.00

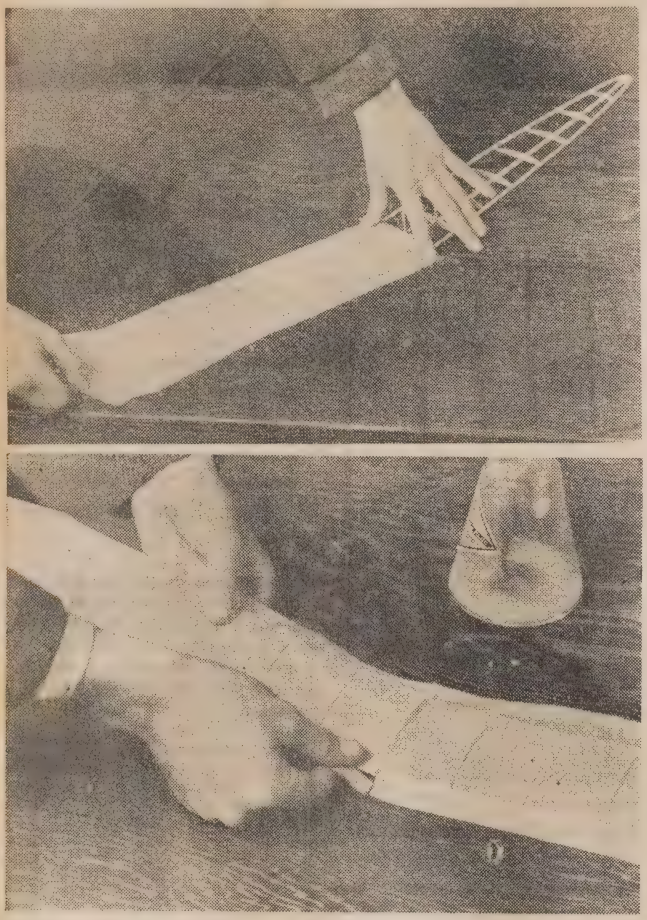
The graph should be pasted on strong card or thin zinc and then cut out. That leaves a perfect template to use as a guide for cutting the ribs.

The section described here is the Eiffel 431, an excellent section for weight rule models possessing great lift, low drag, and very little centre of pressure movement. However, to obtain the best glide, it is necessary to set the wing at about 5 degrees positive incidence.

HOW TO COVER YOUR PLANE

PRACTICE MAKES PERFECT

By JOHN CAVILL



Top: Holding the paper firmly with the left hand, stretch it evenly over the wing frame, previously covered with the paste.

Bottom: Carefully pull out wrinkles, and see that the paper is firmly attached to rib.

One of the biggest differences between the expert and the beginner is the job he makes of the covering of a model plane. As in every other branch of model building, practice makes perfect, and after several covering jobs have been made the beginner should turn out first-class work.

ONE very important point to remember is to cover each section of the model separately. If the wing and tail are to be cemented to the fuselage they must be cemented after covering, not before.

In covering, the grain of the paper plays an important part. Practically always the paper should be applied with the grain running lengthwise. This makes for greater strength. However, when covering a wing it is unwise to have the grain running lengthwise on the underneath. In this case the pull of the paper straightens out the under camber between ribs and ruins the wing section.

Another important point is to use new paper on each job. Most experts buy just enough paper to cover the job in hand; that is, of course, unless they have some way of storing the paper so as to keep it in good condition. In that way they always have neat, uncreased paper with which to cover their models—a very big factor in obtaining a neat job.

WATCH THE GRAIN

Remember, then, when covering wings, to have the grain running chordwise on the underside. For the top the grain is optional; for strength, run the grain along the span, and for maximum efficiency run it chordwise.

A thoroughly reliable adhesive is essential to a good covering job. One of the best and simplest is ordinary cornflour or starch paste, prepared with boiling water.

Other satisfactory adhesives are office pastes and the variety of photographic pastes obtainable.

Now let us get down to the actual job of covering—first, the wing.

Take the wing and apply paste to each rib and strut. The wing should be covered in four sections, the top and bottom of the left and right halves.

Cut the first strip a little wider than the chord of the wing, and two or three inches longer than is necessary. The grain should run along the span.

START FROM CENTRE

Attach the paper first to the centre rib, and then, holding it firmly at the centre, pull the paper gently and lay it on top of the wing. Run the fingers along the leading and trailing edges. When the paper has been loosely attached commence at the centre and work out to the tip, cementing the paper to each rib and pulling it across each section, making the covering job as tight as possible.

Remember to work in one direction only. Gradually eliminate all creases and wrinkles, and be sure that the covering is well stuck to each rib and strut—of course, only those struts on a level with the top or bottom surfaces should touch the covering.

You may have a little difficulty in eliminating creases around the wing tip. The difficulty arises because the paper is forced to bend in two directions at one and the same time. The only thing to do is to pull the paper as tight as possible and trust to luck. It takes an expert to achieve a tip covering without wrinkles, so do not be discouraged if your first covering job looks a bit patchy here and there.

Having covered the top section of the right half of the wing, next turn your attention to the top of the left wing, and cover it in the same way.

After both halves are covered on the top, turn your attention to the bottom. On no account attempt to trim the edges while the adhesive is still wet. Wait till the covering job is thoroughly dry, and then trim with a razor blade. To trim paper your blade needs to be very sharp, so use a perfectly new one.

THE FUSELAGE

Covering the fuselage is quite simple, if the sides are square. If, however, there is very much curvature in the cross section you will find it easier and enjoy better results if you use several strips on each side. The strips should run the full length of the fuselage, and the narrower they are the smoother will be the result.

When using several strips work so that the overlapping is not confusing. You will not be able to trim the overlap until the whole job is finished, so arrange your covering so that the strips overlap neatly. When you use any of the adhesives recommended there is no need to worry about staining the tissue. However, avoid gum arabic, banana oil, or any like adhesive, which, on drying, leaves a transparent stain on the tissue. This applies particularly to covering jobs which embody many strips of tissue.

The method of attaching applies to fairly slow drying pastes. The writer prefers that type of covering, since it allows ample time to eliminate creases and wrinkles, and enables a superior covering job to be achieved with less effort—even though it may be necessary to leave the wing or fuselage overnight before the covering dries.

PHOTOGRAPHIC PASTE

However, many model builders use fast-drying photographic pastes, which result in a quicker job, though not always one as satisfactory. When using this type of paste each section has to be covered with paste and the paper applied immediately. It is necessary to cover two or three inches at a time, and calls for quick work and a reasonable amount of skill.

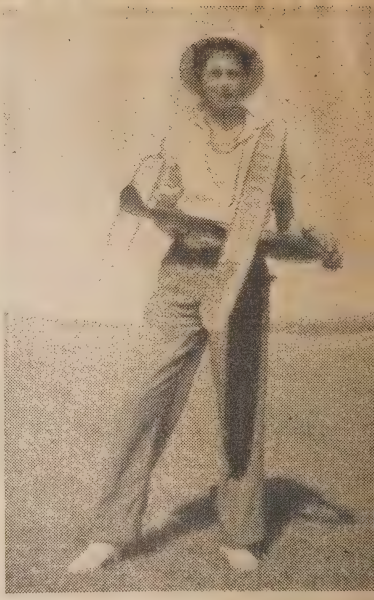
The beginner is advised to stick to the slow-drying pastes until he becomes proficient.

Of course, quick-drying pastes are essential for repair jobs on the contest field, so that it pays to make yourself familiar with this type of paste.

AUGUST MEET OF M.A.A. AT VILLAWOOD

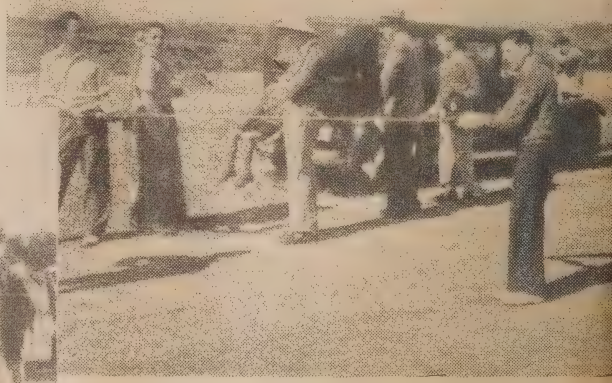
Some spectacular flying was witnessed at the monthly meeting of Sydney Metropolitan clubs on August 27, in competition for the Interstate Shield. An open Duration contest was also held. Here are some pictures taken at the meet.

J. Butcher, of the aerobats, looks around for up currents preparatory to flying his model in the interclub contest. The model, a diamond fuselage machine, flew very well until a broken motor wrecked the fuselage.



Jim Brown, of Chester Hill, who was placed second in the Open Contest. Before the contest commenced Jim sent a model similar to this one, up for a flight of over 11 mins.

Les Annesley, Malcolm Macgregor, and Miss K. Cummins, Recorder, discuss the contest during a lull in flying.



Norm Hansen holds while Kevin Edge packs the turns into his motor. The motor is stretched several times to original length. This enables a great number of turns to be wound on but has disastrous results if the rubber motor snaps during winding! Both of these flyers are from the Waverley Club and Norm Hansen later won the Open Duration contest.

NEW CONTEST RULES
FOR PETROL-DRIVEN PLANES

Passed by the committee of the Model Aeronautical Association and only awaiting the approval of a general meeting, are the new rules governing the championship contest for petrol-driven model planes, to be held at Dumbleton on November 5.

The two principal points in the new rules are: (1) Unlimited fuel allowance, but motor must not run for longer than twenty seconds after take-off. (2) Loading must be greater than 8 ounces to the square foot.

PREVIOUSLY, the rules have allowed a certain volume of fuel for each pound of weight, originally two cubic centimetres for each pound, but lately individual clubs have been running contests with an allowance of only one cubic centimetre to the pound.

It is expected that the new rules will have far-reaching effects on future designs.

EFFECT ON POPULARITY

As usual, there are two sides to the problem of whether the new rule is preferable to the old, and it is by no means evident that all members are keen about the change. It is very evident, however, that the sport has not leapt into popularity in Australia under the fuel allowance ruling.

Although not by any means a certainty, it seems likely that the new rules may help, as they should encourage the building of lightweight models, simple and cheap, and with spectacular performance.

The flight of a big and heavy model is usually stable, and continual flying of these big models tends to become boring.

Lightweight models have a gay life, if a short one.

CRASHING

Whether lightweight models are more easily wrecked, or not, is a subject suitable for long debate. Some modellers claim that the lightweights do not crash so hard, and that, even if they are completely wrecked, they can be re-built quickly and without any great expense. It is readily admitted that any model which is designed to climb at the rate of thousands of feet per minute is likely to be more difficult to control than a bigger model. Models designed to take advantage of the new rules are likely to have less weight than the static thrust of the motor, and there is always that tendency for the propeller to stay still while the model revolves!

COMPARISONS

In America, where the 20-second rule has been in force for some time, the trend has been towards the building of models with a span of about 4½ feet, powered with one-fifth horsepower motors. With a wing area of about three and a half square feet the weight can be as low as 30oz., and still come within the limit.

A model of this type was recently built and flown by Jim Fullarton, and, powered with a "Baby Cyclone" motor, it climbed in a series of loops. It was a most exciting job to watch in the air. It landed very hard once or twice during initial adjustment, but no damage was done.

As the building of a 4ft. model is only a matter of about 15s worth of materials and a fortnight's pleasant spare-time work, it is expected that all those at present in possession of an engine will at least give the new rules a try before they become too emphatic in their condemnation.

CATCHING THERMALS

The element of luck has been removed from the contest as far as possible by the introduction of a rule by which the winner is found from the total flying time of three attempts. This will put a premium on a model which performs consistently, rather than one which strikes a lucky thermal and turns in a 20-minute duration for one flight, and only a minute or two for others.

OBJECTIONS

Those objecting to the new rules feel that the light models will be prone to excessive crashing, causing disappointments, that some builders will be short of the 9s 6d, which a timer costs, and that some of the heavier models will not be able to attain a safe flying height in the 20 seconds allowed.

None of these appear to hold water. Those liable to lose interest because a model crashes are hardly likely to be of the type keen enough to take to competition flying seriously. Those who cannot afford a timer can easily make a device similar to the light and simple timer supplied as standard equipment with the Comet Clipper kit. This consists of a spring pulling a piece of wire through a block of rubber. Any handyman could duplicate it for a few pence.

ADVANTAGES

There is no evidence to support the theory that even the most sluggish models cannot get into their stride in 20 seconds.

Here is Jim Fullarton with his petrol-driven plane referred to in this article.

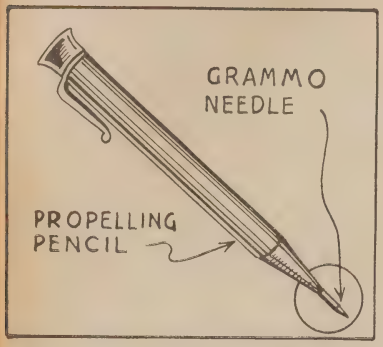
Those in favor of the rule list the advantages as: (1) It will be possible to use adequate oil in the fuel mixture, without being handicapped; (2) It will be possible to take time over jet adjustment before the model is released; (3) It will be possible to keep check of models readily as they are unlikely to fly beyond the limits of the flying-field when allowed only a 20-second run.

BRISBANE RESULTS

Results of the Queensland "Nationals," held a few Sundays ago, indicate that it is not safe to assert that heavy models are encouraged by the fuel restriction method, as the first and second places in the Nationals were secured with models weighing 3lb. 5oz., although the 2c.c. to the pound rule was in force. The winner, H. Murray, of the Lismore Club, flew 21min. 31sec., and second place was secured by H. Habib, also of the Lismore Club, with 21min. 2sec.

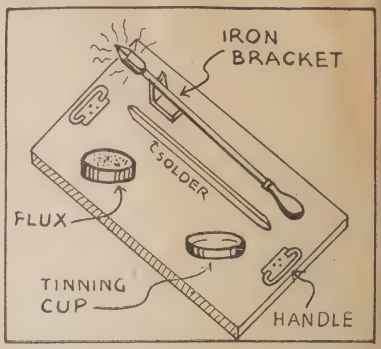
Hints For Your Home Workshop

EASY WAYS OF DOING THINGS



Ordinary used gramophone needles will be found very useful when scribing lines on metal, if used in an old propelling pencil. They are also useful for making points on metal and the fineness of the lines obtained, make them very useful for hobby work, where accuracy is essential.

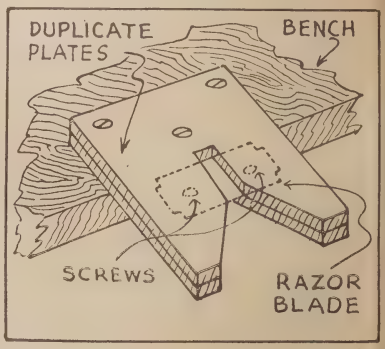
A surprising amount of time may be saved with this simple arrangement from old scraps. Obtain a piece of wood about 15" by 10" and on it screw or tack two old handles, such as seen on four gallon petrol tins. Now bend up a small bracket of brass or light iron to support the iron, when hot. By fixing the flux tin, and a bright clean concave tin lid on the remaining piece of the board, small tinning jobs can be quickly carried out, as it is a simple matter to tin small objects by putting them in the tinning cup, where a little solder, flux and a hot iron will soon do the trick.



A safe and useful string cutter may easily be constructed, to use some of those old safety razor blades.

Procure two pieces of board and screw them together, cut a deep "V" in one end, then parting them insert the blade in the "V." Two screws will keep the blade in place if placed through the holes in the ends, while three more will safely clamp it all to the bench, in a handy position, ready for use.

A handy spirit lamp can easily be made from an old oil can, by cutting off the spout about half an inch from the bottom and inserting a round wick. The other section can be used as a small funnel, with very little alteration.



GUARD YOUR EYES

Nothing is more annoying when working at your bench than to have the light shining directly in your eyes. Even with a lamp whose height is adjustable, such a state of affairs often exists.

If you make up a scoop-shaped shade of metal, black on the outside, and white on the inside, it will guard your eyes from behind, and throw the light away from you on to your work. A few minutes spent cutting such a shade from medium iron sheet will well repay for the trouble.

* * *

To make a paste for sticking paper: Mix boiling water with plain flour, making the solution thick.

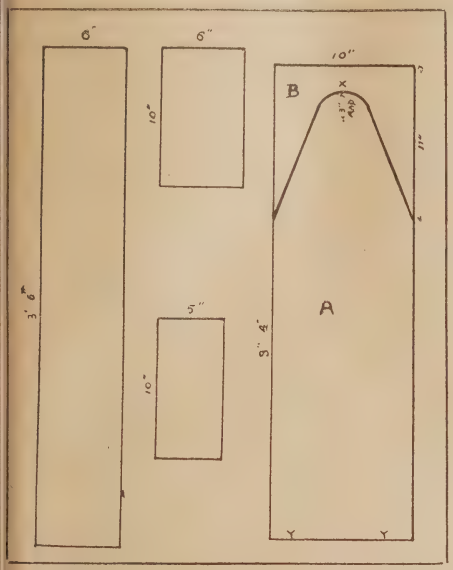
* * *

A good hobbyist always keeps his gear tidy.

A MODERN IRONING CABINET

Novel "how to make" article

Feminine fashions have abolished the need for the large, old-fashioned ironing-board. There are thousands still in use, usually for want of a substitute rather than their actual need. Any wife or mother would be delighted with something more up-to-date. And here is the latest original solution.



The dimensions for the ironing board are given in this diagram. Full details for construction and use will be found in the accompanying article.

Instead of the old blanket-wrapped board, usually a heavy, clumsy thing about five feet long and tapering from 15 to 9 inches wide which must be laboriously lugged from its hiding place when any ironing is needed to be done; to be later smuggled away to its hiding-place behind the door in the bathroom, we have a neat cabinet affixed at a convenient position with storage space for the electric iron, sprinkler, and other ironing accessories, ready for use at a moment's notice.

FOR HEAVY WORK

With the aid of this new device, a single frock or collar can be pressed without upsetting the whole household. And it is sturdy enough to stand up to the strain of many a heavy ironing day.

The ability of the average home craftsman is more than sufficient to turn out a really respectable job on account of the simplicity of the design.

And now to the working details. From the timber-yard procure nine feet of 6 x 1, two feet of 5 x ½; and three feet six inches of 10 x 1 dressed pine, and a couple of feet of 1in. moulding. Additional materials are four 2in. flat-head screws, four black round-head 2in. screws, a dozen 1½in. nails, a few 1in. brads, a pair of offset hinges (of the type used for kitchen cabinets, and the cheaper ice-chests), one small latch bolt and staple, and a pad for the ironing surface.

Commence work by cutting the two sides, and top and bottom to exact lengths of 3ft. 6in. and 10in. respectively. Clean up the outer surfaces and edges with the smoothing plane and fasten together as shown in the drawing with counter-sunk flat-head screws at the top and round-head screws at the bottom.

Then cut the 5 x ½in. board to 10in. lengths for the shelves. If you are capable of doing the job, and think it worth the extra labor, by all means allow a little extra length to the shelves and fit them in a stopped rebate. The rebates, of course, will need to be cut before assembling the sides. An equally good job for the purpose, and a much simpler one is to cut the shelves a neat fit and secure in place with two or three 1½in. nails at each end.

Space the shelves according to your own ideas or requirements, and be sure that they are set level and flush with the back of the cabinet. Punch the nails well below the surface. Then to give the cabinet that professional finish, mitre a piece of moulding across from edge of the top and continue it around the sides to cover the top screw-heads.

Do not use moulding around the bottom, unless you care to go to a bit of trouble with its fitting, as it will interfere with the fitting of the hinges later on. I left the moulding off the bottom of the original and its absence is not at all noticeable.

THE DROP FRONT

Now for the drop front which, when closed, acts as the door of the cupboard, and when lowered becomes the ironing board.

Plane off the front surface and dress the edges and ends to a close fit in the front of the cabinet.

Mark out as shown in the drawing. Keeping right on the line, cut out with a bow-saw or key-hole saw, the shape indicated, remembering that both pieces are wanted. I cut mine on a treadle fret saw. Perhaps the simplest method is to take the marked-out board to the nearest joinery or saw-mill and have it cut on the band-saw. If you do this be sure to give instructions that the cut be made right on the line and that both pieces are wanted, otherwise you may find that the smaller piece has been discarded.

Smooth up the saw-cut edges, removing as little wood as possible and fit the upper piece marked "B" into its position at the top of the cabinet. Fit it flush with the front and secure with a few nails at the sides and top.

The larger piece, which is to be the ironing-board proper, requires a little further treatment. Plane a couple of shavings off all around so that it is an easy fit, and then round off the outer edges. Take a few cuts first on the bevel with the plane, and then round off with coarse sand-paper, finishing with fine sand-paper. If desired, a cleat may be screwed across the bottom end on the inside to prevent warping, but it is not really necessary.

The next step is to attach the offset hinges at points marked "XY." These

(Continued on Next Page)

INDIA and ASIA—Cont.

(From Page 57.)

JLG3.—11,705kc., 25.63m. Another Japanese, which seems to give only programmes for Japanese territories. (Foster, Emery.)

JLT.—6190kc., 48.47m., same location. On a few occasions this one has been heard at good strength, but then suddenly changes over to telephone traffic. (Emery.)

JLG.—7285kc., 41.2m. In the early mornings can be heard at quite good strength, but not on regularly. (Lee.)

XGOX.—15,190kc., 19.75m., Chungking, China. The Chinese authorities have now taken this frequency into use again. Heard in special broadcasts for New York from 9.30 a.m. till 10.30 a.m. (Clack.)

XGOX.—17,800kc., 16.85m., same location. This frequency has been used in the session around midday. (Ford.)

XGOY.—11,900kc., 25.21m., same location. This frequency has been used both in the early morning and also at night. (Lee, K. Mc., Cox, Ford, Foster, Medina, Emery, Semmler.)

XPSA.—7000kc., 42.8m., Kweiyang, China. Still coming in every night with a good signal. (Clack, Cox, Lee, Medina.)

XMHA.—11,850kc., 25.32m., Shanghai, China. Still being heard at night, but not a very good signal. (Ford, Cox, Medina.)

XGAP.—9560kc., 31.38m., Peiping, China. This is the first mention of this station, heard by Mr. Keast at a good strength at 1 a.m.

JOD.—6880kc., 43.6m., Hankow, China. (Foster, Emery.)

ZBW3.—9525kc., 31.5m., Hongkong, China. Still being heard at good strength every night. (Lee, K. Mc., Foster, Ford, Medina, Semmler, Battis.)

RADIO HANOI.—11,910kc., 25.19m., Hanoi, F.I.C. Heard on a few occasions at very good strength, by Mr. Clack.

XGOK.—11,810kc., 25.4m., Canton, China. Mr. Emery has been hearing this Chinese station at 10 p.m. when it is R7.

AFRICA

VQ7LO.—6083kc., 49.32m., Nairobi, Kenya. In the early morning, just before 5 a.m., can be easily logged at quite good level.

IABA.—9650kc., 31.09m., Addis Ababa, Ethiopia. Now seems to close down a little before 6 a.m. and not as strong as previously, though they are very loud about 2.30 a.m.

Radio Tananarive.—6063kc., 49.48m., Tananarive, Madagascar. Opens at 1 a.m. with "Marseillaise," but still a very distorted signal. (Keast.)

Radio Tananarive.—9690kc., 30.96m., same location. This transmitter is much the best, but does not seem to be on regularly.

ZRH.—6007kc., 49.94m., Roberts Heights, South Africa. On some mornings this one is very good till about 7.45 a.m. (Ford, Lee.)

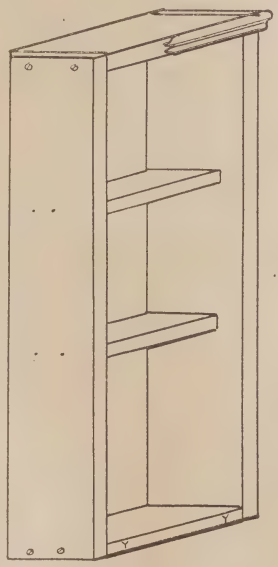
CR7AA.—6137kc., 48.88m., Lourenco Marques, Mozambique. Still being heard in the mornings at 7 a.m.

EAJ43.—10,370kc., 28.92m., Teneriffe, Canary Islands. Still being heard in the mornings till around 7.30 a.m. (Emery.)

A MODERN IRONING CABINET

(Continued from Previous Page).

will allow the drop front to project about a quarter of an inch from the plane of the front of the cabinet, and gives it a more massive and attractive appearance. On account of this projection the bolt will require to be mounted on a quarter-inch thick block to line up with the staple, which will be screwed on to the drop front at "X." When you are buying the bolt



and hinges ask for round-head screws. They give a much better finish.

The cabinet may be finished by staining and polishing or by the use of enamel or brushing lacquer in two-tone effect. I used stain and polish to match the rest of the kitchen furnishings.

When the finish is thoroughly dry the ironing pad may be fitted. For this I used a piece of saddle felt about a quarter of an inch thick, cut to the same shape as the drop front and trimmed a quarter of an inch smaller all around. A piece of strong, unbleached calico is drawn tightly over and tucked under all around. Affix the pad with brass head upholstery tacks spaced every three inches.

If driven well home they will be sunken below the surface of the pad and will not interfere with the ironing. I suppose you are wondering what is going to support the drop front in the horizontal position.

I expended a good deal of time and thought to this little point. Any loose parts were instantly ruled out. A folding leg would be in the way. So at last I hit on the simplest idea of all. Why not support the end of the board on a chair back? It is rigidly secured at all times by the hinges at one end, and a chair is always handy. So the only thing left to do now is to affix the cabinet to the wall.

FIXING TO WALL

There are several methods of doing this. The simplest is to stand the cabinet on the back of a chair against the wall. This gives the correct height. Mark the position with the cabinet vertical and drill holes through the partition. Then, having a helper to hold the cabinet head up against the wall, drive four 2-in. screws from the other side through the wall into the sides of the cabinet. This makes a very strong and tidy job.

If the cabinet is to be attached to an outer or double wall, use four bucket lugs or similar metal brackets. Screw these to the back of the cabinet sides and affix to the wall by screws inside the cabinet. If yours is a plaster wall be sure the screws are driven home into one of the supporting members behind the plaster. There is no back in the cabinet. It is unnecessary and if the power point is at a convenient position the cabinet may be placed over it. The flex and iron are then always out of sight when not being used, without even being disconnected.

So now, when mother or sister wants to press a frock, all she does is to drop the ironing-board on to the back of a chair, switch on the iron, and the job is done.

BERMUDA

We learn from "Radio News" that a short-wave station is shortly to be constructed by the Wireless Section of the Bermuda Volunteer Engineers near Hamilton. The latest news will be broadcast on Monday, Wednesday, and Friday evenings (Bermuda times).

GETTING RESULTS FROM YOUR ELECTRIC DRILL

There are many things one can do with an electric drill besides making holes in a chassis. By a little intelligent thought one can make quite a few attachments for doing odd jobs quickly and efficiently.

THE hobbyist and home craftsman of to-day is fortunately able to choose from an almost unlimited variety of tools. The remarkable increase in the ranks of amateur artisans has resulted in the fact that tool equipment has reached its lowest price level. If you work with metals to any degree you will, soon or late, find that a small portable electric drill will carry the scope of your work further.

VARIOUS ATTACHMENTS

The mere drilling of holes with speed, accuracy and little effort is only one of the many applications of this versatile tool. In fact, it is very much like the modern miniature camera as far as various attachments for extending its scope of working are concerned.

For an electric drill you can make many attachments, all of which are clamped in the chuck, of course. Such attachments do not require much in the way of time or material.

Take a look at Fig. 1. Here we have a piece of round section mild steel or a bolt "sans head," two nuts and two steel washers. This simple gadget will hold a grinding wheel, a wire burnishing brush, or a polishing mop. The machine, of course, is clamped in the workshop vice or held to the bench with a clamp especially made or purchased for the purpose. By the way, about polishing mops—these are easily made up from old household linen. To do this, cut enough discs of material to make a pile about one inch thick, and for the ¼-inch machine about three inches in diameter. Clamp the discs together with a leather washer on each side, drive three nails right through and clinch over. A hole right through the centre then completes the job.

Fig. 2 shows the simplest, though not the least useful, attachment. It is merely a piece of round steel rod with a saw cut about half-way down

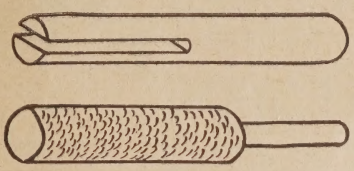


Fig. 2.—More attachments for your drill which will make work easier.

its length. The end of a strip of emery cloth is pushed into this slot and then coiled around. We thus have a very useful internal grinder or polisher for easing out tubes and bushes, &c.

The die-maker or engraver would be lost without his rotary files—obtainable as they are in dozens of different shapes and sizes. They are just the thing for cleaning out those otherwise inaccessible corners, as well as many other uses which are immediately apparent when you look them over. Rotary files of the simpler shapes may be made up by grinding down to form a shank one end of pieces of ordinary round file.

Space does not permit us to discuss further the uses of the portable electric drill, but you can rest assured that, having once acquired one, you will say to yourself, "However did I manage without it?"

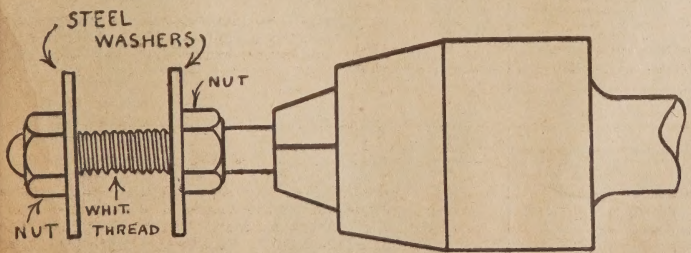
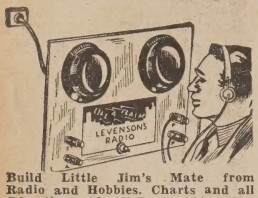


Fig. 1.—With this attachment, you can clamp polishers, grinding wheels, etc., in place, and do no end of useful jobs.

AN INEXPENSIVE ELECTRIC SOLDERING IRON

A simple electric soldering iron requiring only a six volt storage battery as a source of power is simply constructed. Remove the centre carbon from a flash light battery, leaving the metal cap in place. Grind or file to a point the lower end of the carbon and solder a length of insulated wire to the metal cap. Mount carbon in suitable handle. Connect lead from carbon to one terminal of battery and the piece being soldered to the other terminal. Clean joint, apply flux, bring carbon in contact with work, draw back a little, and apply solder as soon as arc has heated work.

Like - a - Flash Cigarette Selling Machines for Wall or Counter, All Metal, Foolproof. Two sizes, holds 15 packets of 6d cigarettes. Price, 32/6. Larger size, holds 24 packets. Price 37/6.
Match Machine for 1d operation, 24 Box Capacity, 37/6.



Build Little Jim's Mate from Radio and Hobbies. Charts and all Directions, 6d. All Parts, 36/- value, 15/4, Batteries 8/9, Phones 10/6. Ready built, complete, £4.

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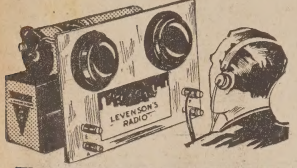
Just like the cowboys use. Imitations, but they look like the real thing. Flash Handles, 3/11, 4/6, 5/6.

Portable Lightweight 1.4 volt 4-Valve Battery Operated Radio, £13/10/-. Full details available.

Dual Wave All Electrical Mantel Model Radios, for all world listening, £12/10/-. Real De Luxe Radio.

Emilco all in one Meter 25/-. AC-DC 0 to 6, 0 to 240 volts, 0 to 50 m/amps, 25/-. Volt-pocket Meters, 2 Reading Volt Meter, 0 to 12, 0 to 120 Volts, 2/6. Telsen, 0 to 9, 0 to 180 Volts, 7/6. Ditto 3 Reads, 0 to 9, 0 to 180 Volts, 0-30 m/amps, 9/6. Wates 4 Read. 0 to 6, 0 to 15, 0 to 180, 0 to 30 M.A., 14/-. Telsen All in One Combination, 0 to 8, 0 to 16, 0 to 240 Volts, 0 to 30, 0 to 300, m/amps, 17/6.



Build Little Jim, the splendid set from Radio and Hobbies. Easy-way Charts and Instructions, 6d. All Parts, 32/-, Valves 13/6, Batteries 11/6, Phones 10/6 and 12/6. The set ready built, complete, £3/16/6.

SPECIAL —— 2/-
Giant size, easy-to-follow Map of Europe. Black on White. 40 x 30 in. folder. Areas, Populations all Europe.

Like - a - Flash "Elimi noise" Aerial Kit for short or dual-wave sets. Aerial, Pyrex type Insulators, transposition blocks and 200ft. aerial coil, 22/6. Eliminates unwanted aerial and hideous electrical noises from your dual-wave or short-wave set.

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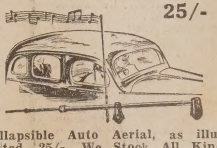

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Paper Knives, replicas of swords, bayonets, &c., with names of famous European towns etched on blade. Made of chrome-plated brass. Pearl, wooden and metal handles. Prices, 3/11, 5/6, 6/6, 8/6, 9/6. Small Bayonet Tie Pins, 2/9. Gun and Bayonet Brooches, 2/6.

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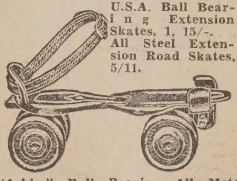

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Poker work instrument for designing on woodwork, complete with 3 needles, 4 heats, 65/-.

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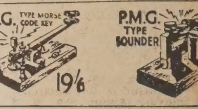
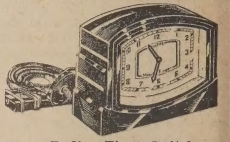
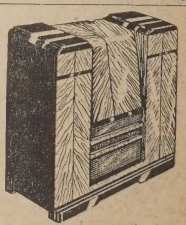


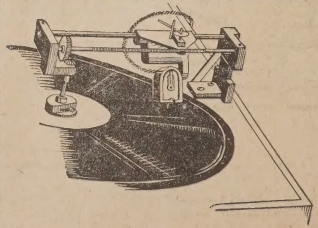
48/6
Just arrived from the maker in London, "Cosmocord" De Luxe Crystal Pick-up, with incorporated Vol. Control, 48/6. Usual price 75/-. Write for Full Lists. Just arrived British-built "Cosmocord" De Luxe Gramophone Pick-up with Vol. Control, incorporated 38/6 value. Now 25/-.



Mapps, Radio Time Switch and Clock combined, 22/6. Automatically switches on your radio at any desired time. Reliable timepiece.



Handsome Radio Cabinet, latest sloping front design. Overall dimensions, 28in. x 33in. Genuine £4/4/- value, now 39/6. Freight and packing extra.



MAKE YOUR OWN GRAMPHONE RECORDINGS
Overhead cutting gear as illustrated, with cutting head, £6/6/0. Records 4/- to 7/6. Sapphire Cutting Needles, 30/-; Steel Cutting Needles, 2/- Play Back Gramo Needles, 2/- Box.

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ANSWERS TO CORRESPONDENTS

H. McLoughlan (Wooroonooke, Vic.): Thanks for letter, have posted booklet as requested. Write again if still in doubt.

H. Larnach (Penshurst): List of books sent. "New Tricks and Stunts" is a good book for 1s 6d at most dealers. Magic dealers sell Ventriloquist dolls. The heads may be purchased separately for about 15s each.

G.T.B. (Marrickville): Posted book some time ago. Write again if not suitable. Would not recommend smaller cards for sleight-of-hand. Standard cards are best and with a little practice you should be able to do the tricks mentioned.

David Clements (Eugowra): That is a very good trick you mention. Will send solution and list of books in few days. Thanks.

J.T.C. (Oatley): Thanks for letter and good wishes. Glad you like the Magic pages. The trick is sold at about 1s, it would fit into your programme O.K., but is only suitable for drawing room.

Hartley Newell (Goolwa, S.A.): Thanks for letter and trick. We will use the trick in one of our early issues. Send more.

N.H. (Kensington): Many happy returns of the day. That is a wonderful programme. Would you like another pen-friend. Will write more fully to your last letter. Write again.

Cliff Jones (Stockton): List of book sent. Ventriloquism is not difficult. The jaw of the doll moves. About £2. Hoffmann's books are very good. Send me a photograph of yourself. Regarding hypnotism—NO.

F. E. Grose (Albury): Thanks for suggestions, they are very good and we may be able to use some of them. Write again. I like your stage name.

Leslie Little (St. Kilda, N.Z.): Will post you the name of a pen-friend, also names of suitable books. Card tricks are not difficult, unless you want to learn sleight-of-hand, this requires much practice. "New Tricks and Stunts" is a good little book for a start.

N.J. (Gladstone, Qld.): Am finding difficulty in locating a copy of the book you mention. Will do so as soon as possible. Will write you soon. Regret photographs all sold.

Vincent Carey (Woodlands Park, S.A.): Thanks. Will send list and book. Write again if you wish. Would be glad to hear from you.

I.A.S. (Stockton): Evidently you were making the circuit through your body, when you held the end of the wire. We will try to publish simple circuits from time to time, but must portion out our space so that everyone has his share. Thanks for your very nice remarks.

D.B. (Rockhampton): The stamp must have been lost, because it didn't arrive! However, we have at the moment copies of the issues available, and you can have them if you send us 6d for each copy you want. We will post them direct to you.

J.L.L. (Gilgandra): By all means let us have the article, if you think it is not beyond the capabilities of the average man. You may be a good deal handier than they are, remember. Still, we would be quite prepared to consider the article in question.

E.K.F. (Pauncham): Sorry we can't handle the mail queries. There should be no great need to alter the layout very much. Use a bit bigger chassis, and make your cabinet larger to accommodate the speaker. If the speaker is not to be mounted on the chassis, the layout need not be changed. A few inches either way isn't important, and we suggest you add enough any way you like to the chassis dimensions. If you keep the components roughly in the same order, you can't very well go wrong. Without knowing exactly the sizes of everything, it is almost impossible to work out a layout.

A.E.R. (Scarsdale): We suggest you have a look at the amplifier in this issue. It seems to be just what you require. Please don't ask us to work out resistance values for direct coupled amplifiers these days—honestly, we have enough headaches as it is. The circuit referred to above will probably overcome your troubles about the expense of the audio transformer, and also the output. Its performance should be comparable with the Stereoscopic No. 2, which had so taken your fancy.

J.F. (Sandringham): Your suggestion about an article on Direction Finders has been noted, and we will try to get an authoritative article written about them. The circuit in question would probably be a parallel-tuned circuit. Why not write to Mr. Graham about it? He would be pleased to hear from you.

W.N.S. (South Murwillumbah): Your circuit seems to be O.K. The 1K4 as a triode, according to data sheets, needs only 4.5 volts bias, not 22½ volts. We suggest about 4.5 volts bias for the 1K6. The 19 will get a little warm, although it should not get hot, if your circuit is as you have drawn it. We can't think what would make it get "very hot" when wired this way. We have something in mind for vibrators some time soon.

"Dot 'n Dash" (New Zealand): At present we believe we are the "largest selling journal of our kind in the Southern Hemisphere," and one of the largest in the world, strange to say, if there is another journal quite like ours, which we doubt! The set in the first number was a particularly good one in every respect, although not meant for pick-up use. See the diagram in this issue for adding a tone control (Advance '39). The best all-round short-wave receiver would be the switched-coil job recently described. The matter of transmitters is now ruled out of the picture, as amateurs are not permitted to operate.

> Readers are invited to send questions on Radio or Hobbies, for reply through these columns. Don't make your question too long, or too complicated. Remember space is limited, and we can't explain "What is Radio?" in two inches of type. Replies will appear in the first available issue. Interesting subjects, too involved to be handled here, will be accepted as suggestions for articles elsewhere in the paper.

G.D. (Auckland): Thanks very much for your letter—we will remember it.

M.Y. (Adelaide): Thanks for your suggestions. Unfortunately, we wouldn't be doing any good now by describing transmitters, although we think they have had their share, with three in six months. The valves referred to are expensive and hard to get, and not suitable for wholesale use. The inclusion of highly technical articles is a bit of a problem, although we are getting some into print which are not beyond most of our readers. Mathematics are often unappreciated, except in special cases. Just one of the problems in trying to cater for everybody!

G.J.H. (Cooparoo): The transformer used for this set, although originally specified as 385 volts per side, is actually only 325 volts. We received this information after some of the diagrams were drawn, and were only able to partly correct the point in the first article. The point was referred to, we believe, in the next issue. However, it works out quite all right in practice just as we have it. This also accounts for the lower bias we used on the output valve. You will find it just about right in practice.

J.L.A. (Bunberg): We suggest that you sketch out the circuit you have in mind and submit it to us for comment. It's rather hard to follow it completely from your description, although it sounds feasible. The article on antennas is a good idea, but, of course, not much use now the amateurs have ceased transmitting. Yes, it is often possible to use low voltage on the oscillator, but sometimes better to use higher voltage, particularly where high output is required. Thanks for your letter and kind remarks.

G.F. (Ashfield): It is hard to say where the trouble lies, but, providing the 750 ohms resistor is continuous, and not mechanically faulty, it is hardly likely to be the cause. However, a new one wouldn't do any harm—its wattage would be 10 watts for safety. Such a resistor isn't very expensive. It might, however, be a faulty 57, if you are using this as a phase-changer—a leak from cathode to filament would cause trouble. On the other hand, the 50's might be gassy, and this would be worst when they were hottest. Have you had them long? If possible, note their change in plate current, if any, when in operation. It is possible also that the speaker transformer is at fault.

A.C. (Cessnock): Don't like the use of such a connection for the filament from the 240 A.C. Suggest that you use it, but employ a transformer to get the correct filament voltage. Then you will be safe.

J.E.D. (Kempsey): It would seem that the Advance '39 would be the ideal set for you. It works very well, is suitable for pick-up, and doesn't cost a fortune to build. What do you think of it? Suggest you contact one of our advertisers, who may be able to get the set built for you.

D.B. (St. Peters) wants to build a "sun-tanning" lamp.

A.: We strongly advise you against experimenting with ultra-violet ray apparatus unless you know exactly what you are doing. It is possible to do considerable harm to the skin by careless use of such a lamp. We had a personal experience of this kind while undergoing supposedly mild treatment with such a lamp many years ago. Due to the possible carelessness of the operator, we spent an agonising week wrapped in cottonwool while the skin came off our back! There are three stages of burn—the familiar reddening, the blister stage, and the charring stage. Take our advice, and if you want such treatment, have it properly administered. Even if it is just to get a good preparation for the summer bathing season, as evidently you desire.

C.G. (Footscray): Yes, you can connect a speaker to a crystal set, although we won't guarantee results! A very sensitive type is best—some of the old horn types were good, such as the large Brown speakers. If you can hear the stations some distance away from the phones, the reception should be reasonable, but not otherwise. We don't advise buying an expensive speaker specially for your little set, as your results may not be satisfactory.

H.R.B. (Rockhampton) wants to learn the Morse Code quickly.

A.: Reams have been written about how to learn the Morse Code. Apart from writing a full-sized article on the subject, we can only suggest that you start off with the key and memorise the code. If you can get a friend to learn with you, half your troubles will be over. However, by using a short-wave set, and searching for slow commercial stations, you will soon be able to pick out a letter or two here and there, and then complete words. The first stage is the hardest, and there is no quick way to success. What about writing to one of our radio colleges, which specialise in such things? Their experience should be very valuable to you, as there are dozens of others who no doubt are in exactly your position. Advertisements for the A.R.C. appear in this issue.

B.S. (Crabb's Creek) receives stations well in the daytime on his little set, but not so good at night.

A.: It must be some characteristic of your location. Generally, it's the other way round. There doesn't seem to be any other explanation, as the set can't tell the difference between night and day. It is rather unusual, but not by any means impossible.

ANSWERS

G.P. (Homebush): The connections are as follows. The A minus of the A battery connects to one side of the battery switch, the other side connecting to the chassis. The A plus of the A battery is connected to the A plus terminal of the valve. The B minus terminal of the B battery is connected direct to the chassis. The B plus terminal of the B battery is connected to the lead running to the phone terminal. This explanation should make everything quite clear. You will find all these connections clearly shown in the circuit diagram.

R.J. (Merewether): Thanks for your nice remarks about our paper, which we much appreciate. Glad you liked the June issue. Do you think this one is better? Unfortunately, we were all set to publish quite a number of articles on amateur transmitters, but now, of course, that would be impossible. There is no way you could maintain calibration without changing trimmers, but have a look at the set described in this issue. It should give you some ideas.

J.R.C. (Bungowannah): The two-volt vibrator is made by R.C.S. The output is about 100 volts at 30 mills., but the current drain from the battery is several amps—necessary because the wattage input must be maintained. We could not say off-hand the price of the vibrator, but if you write to one of our advertisers, no doubt they can give you full information.

W.H. (Garden Vale): If you write to Mr. Alf Barnes, care of our paper, we will send your letter to him. No doubt he will be pleased to answer your questions.

M.H.H. (Brisbane): Thanks for your letter, and the list of stations you have received. You are doing very well. The station, as you say, evidently serves the cars it calls, but have not heard it here. The circuit you sent will probably be used in an article on small sets which we have half-prepared for publication at some future date.

P.J.P. (Ellistan): It is not vitally necessary to have intermediates matched to the tuning coils, as you put it. As long as the intermediate frequency is suitable, you could mix the makes, providing they are good ones. It is desirable, however, to use two intermediates made by the same firm, as they will, no doubt, be designed to work together. The kit referred to would be suitable for the 1C6 or 1A6 in the main, although strictly speaking there is a difference. If you can get the right coils, by all means do so. Two-volt valves for the portable would be the 1A6, 1A4, 1B5, and 1F4, although they are not quite the same. For instance, you would have to bias the 1B5 to about three volts, and also the plate voltage should be raised to 135 volts. Oscillator grid leak must also be changed to 50,000 ohms. With suitable changes to the circuit, these valves would be suitable. You should get plenty of punch from the 1.4 valves if properly use.

D.M. (Melbourne): We can only suggest that you write to one of our advertisers, and inquire about the price of the parts for Little Jim's Mate. Any of them will be able to quote you, but it is very low. We are glad you like our magazine, and appreciate very much your very nice remarks.

G.W. (Christchurch): By the word "bracket" we meant to imply the small dual-wave assemblies which mount the set in the manner of a bracket. Other types which incorporate a number of coils on a larger switch, we generally call units. However, actually, they are the same thing, when looked at from your angle. You will find the type of coil assembly advertised in this issue. The 6K8G you may not have in New Zealand, as it is an Australian valve. However, the metal 6K8 would do just as well. The EBL1 is a Philips valve, and we should have thought it would be obtainable in New Zealand. We don't know of another type which would take its place. Mullard also make an equivalent. The AJ11 is made by the Australian firm of Efco, and again we don't know whether it is obtainable in N.Z.

T.W. (Bridgetown): Some time ago we published a four-valve set for vibrator work, and since that article appeared there has not been very much in the way of improvements which we could make. However, at this stage, even a reprint of the article might be worth while. If enough readers ask us for the four-valve vibrator receiver, we may consider doing something about it. Just at the moment we hadn't intended to run anything immediately.

C.W.B. (Hawkes Bay): Make the primaries about two-thirds the number of turns of the secondaries, and make one-half of them interwound with the secondaries. Use fine wire, about gauge 30.

— (Broken Hill): We can't publish diagrams as a rule in these columns, but a short article on adding A.C.C. to standard receivers might find a corner somewhere in a future issue. You could probably add the extension speaker by wiring it from plate to plate of your set's output valves, with .1 mfds. blocking condensers in series with the leads to it. However, the impedance of the speaker will probably be rather low, compared with that required for the output valves, and you may suffer a reduction in volume as a result. However, that is the way to do it, if you want to give it a trial

V.F.H. (Misima Island): Sorry, but we couldn't possibly answer your questions on radio coil design theory in these columns. However, an article in this issue will probably clear up many of your problems for you. The others would need such detailed treatment that you would be better advised to consult a good textbook on the subject. We may run an article on aerials some time soon, with special reference to their use for shortwave reception. Transmitting aerials are now hardly worth the space, as no one can use an amateur transmitter in Australia.

W.K.L. (Teralba): We do not know definitely whether one is restricted in flying gliders, but do not think there is anything to prevent you, if you wish to have a shot at it. At the same time, we advise the utmost caution, and suggest that you go very carefully unless you know a good deal about the game. It's no good worrying about it afterwards!

R.B. (Broken Hill): Glad you have built the Portable set with such good results. Apparently you are only one of many! Yes, some sets now use a genuine "loop" aerial, which is actually one of the tuning coils in the set. We are trying now to get manufactured a suitable coil for use in the Portable, and when it is ready we will give details of how to fit it. At the same time, your set should not be far behind with about a 4ft. rod aerial.

R.M. (North Perth): Sorry, we can't answer queries by mail. The article did not include a sketch of the valve sockets, so we can't quite understand your query re the connections. Suggest you get one of the latest valve sheets, which will give full information on the connections. We can't suggest 4-volt valves suitable for this set, as these would alter the design entirely, and there are no equivalents for some of them. Afraid it means a new transformer. Yes, it is a pity the amateur transmitters are not now allowed to operate, but this is only a small thing compared with the bigger ones at stake. Thanks for your remarks about our paper, and we are glad you like it.

N.V.J. (Brisbane): Your circuit is very interesting, and we are glad you get good results from it. You could also try connecting the two grids together—that might work even better. We don't think this valve is universally obtainable—possibly there were a few surplus valves in Brisbane, and they are not now used in modern circuits. But for your purpose it is quite a good one.

M.G.H. (Geelong): It is very hard to say what stations you would receive on Tiny Tim, where you are, but we should think that many of the Melbourne stations would be heard, if you are not too close to the local station. Otherwise, it might override most of them if you used the longer aerial required to get Melbourne. It is not altogether the best set for you to build, for this reason.

"A Beginner" (Launceston): From time to time we do print articles of the type you mention, and there is always something of the kind in "Wireless Weekly," which has a Junior Technical Section. You could copy the amplifier circuit from one of the 2-valve sets we have published from time to time. We don't advise making gramophone pick-ups at home, as they are rarely satisfactory, and would probably give you no end of trouble, as well as being heavy on your records, unless they were elaborate, and thus costly.

L.M. (Auburn): We have no special book on making crystal sets, but we can send you one of our handbooks, including such an article, if you send us 6d in stamps with a request for it.

W.P. (Brisbane): The first named circuit would probably be a little bit better than the second. About 300 ohms. would do for the bias resistor. The single 6L6 is quite a good output valve, particularly if used with inverse feedback.

J.S. (Middle Tarwin): We would suggest about 55 turns for the grid coil to cover the broadcast band.

N.D.L. (Reservoir): Glad you like the paper so much. Afraid there is no point now in worrying about the A.O.C.P. as you couldn't get it if you wanted to. The degree of M.I.R.E. is pretty hard to get, and one has to be a radio engineer of considerable experience and ability to obtain it. The course you mention would be helpful, but still a long way off. The circuit you send is pretty straightforward, but would work better with an aerial coil instead of the direct connection. A transformer would probably be better also than the direct coupling method to the detector. The wire you send is probably 20 gauge enamelled copper. It would be suitable for coils of about two and a half inches diameter.

R.M.F. (Willoughby): With care over the coils, the set should work quite well on 10 metres. The intermediates you mention will probably be quite successful. There is no need to worry about the valves mentioned needing laboratory apparatus to get them going properly. The 6K8G is a particularly easy valve to make operate very well. If you follow our instructions, you will probably have no trouble at all with it.

R.G.R. (Petersham): You can obtain valve data sheets which will give you full details about the valve connections from any good radio dealer. There is no reason why the 4/39 should hold you up, even though it is a dual-waver, although a little more experience in lining up sets, etc., would certainly have been a help. Still, the 4/39 is a very easy set to line up. Instructions for lining up will probably be found in the article, and, in any case, these are repeated for the Advance '39 in this issue. They also apply to the 4/39. It is hard to say whether there have been any more suitable circuits. However, the Advance we think is even more foolproof than the 4/39, and will, of course, give you rather better broadcast results, being a bigger set. Thank you for all your good wishes.

G.B. (West Preston): The set you mention would probably be as good as any for the work you intend. It will work with both iron or air cored coils. We don't remember now which we used. The long grid lead may be shielded if any feedback is noticed without this shielding.

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